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East Coast Newfoundland Herring
1984 Assessment

by

J. P. Wheeler. R. Chaulk and G. H. Winters
Fisheries Research Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's Newfoundland A1C 5X1

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Abstract

Analysis of data collected during 1984 is presented for the three east coast Newfoundland stock complexes: 1) White Bay-Notre Dame Bay, 2) Bonavista Bay-Trinity Bay, and 3) Conception Bay-Southern Shore. Landings in 1984 were approximately 1250 t and came from a bait fishery and a limited gillnet fishery late in the year (November). Samples from these fisheries showed the increasing dominance of the 1979 yearclass. Samples from the research gillnet program showed similar trends plus the relative strength of the 1982 yearclass as two-year-olds. The acoustic purse seine survey showed significant concentrations of the 1982 yearclass in all areas. Catch rates from the research gillnet program showed a slight decline from 1983 to 1984. A normalized gillnet catch rate series, developed from commercial and research gillnet data, showed large catch rates in the late 1970's, bottoming out in 1981 and increasing in the 1980's. It was impossible to obtain a best estimate of F_t from total mortality coefficients (Z); however, total mortality rates derived from catch curves suggested a very low F_t. A method was developed to determine stock biomass from the acoustic survey. These biomass estimates and subsequent population vectors were projected to 1986 assuming a fixed catch in 1985. Trends in biomass, fishing mortality and recruitment were examined and management considerations are provided for 1986.

Résumé

L'analyse des données recueillies en 1984 est présentée pour les trois complexes de stocks de la côte est de Terre-Neuve : 1) baies Blanche et Notre-Dame, 2) baies Bonavista-de la Trinité, et 3) baie de la Conception, côte sud. Les débarquements de 1984, d'environ 1 250 t, provenaient de la pêche à la boëtte et, dans une moindre proportion, de la pêche au filet maillant en fin d'année (novembre). Une analyse d'échantillons a montré que la classe d'âge de 1979 domine de plus en plus. Des échantillons du programme de recherche sur la pêche au filet maillant ont révélé des tendances semblables ainsi que la force relative de la classe d'âge de 1982, composée de poissons de deux ans. Le relevé acoustique à la senne coulissante a indiqué d'importantes concentrations de la classe d'âge de 1982 partout. Les taux de capture déterminés dans le programme de recherche sur la pêche au filet maillant ont chuté légèrement de 1983 à 1984. Une série normalisée de taux de capture au filet maillant, établie à partir de données commerciales et de données de recherche sur la pêche au filet maillant, a révélé de forts taux de capture vers la fin des années 70, avec un minimum en 1981 et une reprise dans les années 80. Il a été impossible d'obtenir une meilleure estimation de F_t à partir des coefficients (Z) de mortalité totale; toutefois, les taux de mortalité totale dérivés des courbes des prises indiquent un F_t très faible. Une méthode a été mise au point pour déterminer la biomasse du stock à partir des relevés acoustiques. Ces estimations de la biomasse et les vecteurs subséquents de population ont été projetés jusqu'en 1986 en supposant un nombre fixe de prises en 1985. Les tendances de la biomasse, de la mortalité par pêche et du recrutement ont été examinés et l'on en tient compte pour planifier la gestion des stocks de 1986.

Introduction

1) Description of the Fishery:

During the 1970's there was rapid development of the herring fishery along the east coast of Newfoundland. From 1970-73, landings averaged 3500 t annually, mostly from fixed gear as was the case traditionally. By 1976, landings had increased to 25,000 t due to the recruitment of the very large 1968 yearclass and the involvement of a fleet of large purse seiners and small (< 65 ft) ringnet vessels. The mobile purse seiners were excluded from the fishery in 1977, the same year the ringnet fleet was first placed under quota control. All gears were placed under TAC's in 1980; however, in the interim, gillnet landings increased rapidly from 15% of total landings in 1976 to 50% in 1979. TAC's were substantially reduced in the early 1980's due, primarily, to poor recruitment during the 1970's. The ringnet fishery was closed in 1982, likewise the entire fishery in 1983 with the exception of a limited fixed gear bait fishery and by-catches in the capelin and mackerel fishery. Despite advice that the fishery remain closed, a TAC of 2000 t was set in the fall of 1984. However, only approximately 50% of this amount was caught (Tables 1-3). It appeared that this may have been due to the late opening date (November) and poor market conditions.

2) Nominal Catches:

TAC's and landings ($x10^3$ t) are listed below for 1977-84.

	1977	1978	1979	1980	1981	1982	1983	1984
TAC	22.0	17.4	20.8	9.8	7.0	2.0	0.0	2.0
Catch	25.7	23.4	26.4	12.4	9.0	2.6	0.5	1.3*

*Preliminary

Input Data

1) Stock Delineation:

As was the case last year (Wheeler et al. 1984) east coast Newfoundland herring were considered as three stock complexes (Fig. 1): 1) White Bay-Notre Dame Bay (3Ka, 3Kd, 3Kh and 3Ki), 2) Bonavista Bay-Trinity Bay (3La and 3Lb), and 3) Conception Bay-Southern Shore 3Lf and 3Lj). These areas were defined after examination of tag returns of experiments conducted along the east coast from 1975-81 (Wheeler and Winters 1984a). However, due to the homing tendencies of the fish (Wheeler and Winters 1984b), the provision of scientific advice depends upon the nature of the fishery.

2) Biological Sampling:

The number of fish sampled, both commercial and research, dropped slightly from 1983 to 1984 (Table 4). This was due to the introduction of a program designed to reduce duplicate sampling of the commercial fishery. This program should lead to more efficient sampling again in 1985. Similar to 1983, research samples outnumbered commercial ones by 3:1 due primarily to the research gillnet program and acoustic purse seine survey. However, even excluding research samples, there were in excess of 200 herring sampled per 100 t of commercial catch.

Commercial catch-at-age data (Tables 5-7) for 1984 were generated by applying age compositions from the appropriate commercial samples to landings. However, similar to 1983, in certain cases, research samples collected from commercial mesh size (2 1/2" and 2 3/4") gillnets were used to generate catch-at-age data where no commercial samples were available.

3) Acoustic Purse Seine Surveys:

For the third consecutive year two commercial purse seine (< 65 ft) vessels were chartered for four weeks in October-November 1984. The survey commenced in Notre Dame Bay and proceeded southward through Bonavista and Trinity bays (Fig. 2-7); 1545 kilometers were effectively surveyed during 362.5 hours - 1957 schools of fish were identified and measured (length and depth) during this period (Table 8). Similar parameters have been calculated for the 1983 survey (1982 calculations have not yet been completed).

There were 47 successful sets during the 1984 survey; herring were caught in 39 of these, mackerel in 8 (Appendix 1). Juvenile herring predominated the sets in which herring were caught: 1982 yearclass in 32 sets, 1983 yearclass in 12 sets and 1984 yearclass in one set. Mature herring (age 5+) were caught in seven sets. As was the case in the preceding two years, the 1982 yearclass appeared in significant concentrations in all areas surveyed.

4) 1984 Age Compositions:

Age compositions of herring from the acoustic purse seine survey samples, 1982-84, show this dominance of the 1982 yearclass (Fig. 8). For 1983 and 1984, both unweighted (samples only) and weighted age compositions are given. Weighted percentages were derived by applying age compositions of samples from subareas to abundance estimates (m^2 of schools observed within the subareas) and then combining subareas within each stock area. Spring and autumn spawners have been combined in Figure 8; however, it appears that these juvenile fish (1982 and 1983 yearclasses) are predominantly spring spawners as, in all areas, greater than 90% of the fish sampled were spring spawners.

For the first time since the 1970's, age 11+ fish did not dominate the commercial fishery (Fig. 9). In all areas, the 1979 yearclass continued to show increasing dominance, representing 35% of the catch in White Bay-Notre Dame Bay, 50% in Bonavista Bay-Trinity Bay, and 65% in Conception Bay-Southern Shore. Once again, there was a slight increase in the percent of autumn spawners in the catch, and similar to that of the 1979 yearclass, percentages increased from north to south - 17% in White Bay-Notre Dame Bay, 23% in Bonavista Bay-Trinity Bay, and 46% in Conception Bay-Southern Shore.

The age composition of samples from the research gillnet program (Fig. 10) showed similar trends to that of the commercial catch, with the 1979 yearclass dominating in most areas. Unlike the commercial fishery age compositions, this trend was also evident last year in the research gillnet age compositions, thus illustrating the importance of the research gillnet range in mesh sizes (2"-3") as a predictor of incoming recruitment. Similarly, this year, the 1982 yearclass showed relatively strongly as two-year-olds, representing 8%, 13%, and 18% of the fish sampled in White Bay-Notre Dame Bay, Bonavista Bay-Trinity Bay, and Conception Bay-Southern Shore, respectively. This represented the greatest percentage of two-year-olds caught over the five year time series.

5) 1984 Age Specific Weights:

Mean weights at age for 1984 (Table 9) for White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay were derived from samples collected from January to June. Samples collected throughout the entire year were used to determine mean weights at age for Conception Bay-Southern Shore. Both commercial and research samples were used in these calculations.

6) Abundance Indices:

Four abundance indices have been calculated for both the 1983 and 1984 acoustic purse seine surveys (Table 10). For each of the indices, 1) number of schools observed per kilometer, 2) number of schools observed per hour, 3) square meters of schools observed per kilometer, and 4) square meters of schools observed per hour, there was an increase from 1983 to 1984. These may be explained both by increased abundance and increased availability, i.e. fish of the 1982 yearclass were larger than in 1983 and were thus more readily accessible in the area surveyed.

The research gillnet program provided catch rates for the fifth consecutive year. In 1984, 12 east coast fishermen (Tables 11-13 and Fig. 1) were contracted to fish a fleet of five gillnets, ranging in mesh size from 2" to 3". for a period of one month (October-December), to maintain an accurate daily log record of catches and to collect and freeze samples from their catch.

However, in some cases. due to a change in the depth of nets provided to certain fishermen in 1980-82, total catch (Tables 11-13) and hence catch rates had to be adjusted before comparisons could be made. The adjustment factor chosen, (Deep = 3.50 x Shallow). was based upon comparisons of catch rates of shallow (old) and deep (new) nets conducted in 1983 and 1984 (Table 14). Further comparisons will be made in 1985 to more accurately define this factor.

Two catch per unit effort indices were calculated from the research gillnets· 1) number of herring caught per fishing day (Tables 15-17) and 2) number of herring caught per days hauled (Tables 18-20). In White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay, catch rates declined slightly from 1983 to 1984 for both of the indices. In Conception Bay-Southern Shore, both indices increased greatly from 1983 to 1984. Over the five year time series, the same general trends existed in all areas, i.e. decreasing catch rates from 1980 to 1981 or 1982, increasing to 1983 and slightly decreasing in 1984.

This year, a normalized gillnet catch rate series was developed (Table 21) for White Bay-Notre Dame Bay (1977-84) and for Bonavista Bay-Trinity Bay (1979-84). It includes commercial gillnet catch rates (Wheeler and Winters 1983) from either 1977-82 (White Bay-Notre Dame Bay) or 1979-82 (Bonavista Bay-Trinity Bay) and research gillnet catch rates from 1980-84. It was impossible to include Conception Bay-Southern Shore as research gillnet catch rates exist for 1983 and 1984 only. The commercial gillnet catch rates were converted from "kg/net/landing" to "number caught/net/landing" and then normalized. The research gillnet catch rates were converted from "number caught/2 1/2" and 2 3/4" nets/day hauled" to "number caught/net/days hauled" then logged to reduce the large fluctuations caused by small sample sizes (in particular White Bay-Notre Dame Bay in 1979 and Bonavista Bay-Trinity Bay in 1982) and then normalized to make them directly comparable to the commercial series. Only the 2 1/2" and 2 3/4" research gillnets were considered as they represent standard commercial mesh sizes. In order to avoid bias in choosing a common year (1980, 1981, or 1982) in which to normalize each series, each was normalized to the mean catch rate of the common years (1980-82). Both areas exhibit similar trends when the two time series are combined. Each shows large catch rates in the late 1970's. bottoming out in 1981. increasing to 1983 and decreasing in 1984.

Estimation of Parameters

1) Partial Recruitment

In determining partial recruitment rates (Table 22). an attempt was made to empirically assess the younger age groups, in particular the 1982 yearclass. The weighted age compositions. derived from the 1984 acoustic purse seine survey (Table 8 and Fig. 8) were considered to represent the population age structures. Commercial catches at age were compared with these population age structures and the ratios that were derived were normalized to give partial recruitment patterns. For both areas, White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay, full recruitment occurred at age 5 or 6. As expected, since the 1984 commercial fishery was entirely by gillnets, recruitment of the 1982 yearclass was very low (0.001). Also, recruitment was dome-shaped with age 11+ fish (primarily 1968 and 1969 yearclasses) being only partially recruited (0.35). This is in agreement with Olsen (1959) and was similar to the selectivity pattern used in last year's assessment.

2) Calculation of Total Mortality (Z):

Instantaneous total mortality estimates (Paloheimo 1961) were calculated for ages 3+ for each of the research gillnet catch rate series (Tables 23 and 24). Age 3+ was chosen after examination of the catch-at-age data from the research gillnet program (Appendix 2) as it appeared that full recruitment to the research gillnets occurred at age 3. Although it was impossible to discern any trend in Z values due to numerous negative values. it did appear that total mortality and hence fishing mortality was low in most areas over the past two years.

Trial runs of cohort analysis were conducted for White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay to determine the best relationship between biomass (5+) and catch per unit effort (normalized gillnet series) (Table 21). However, it was impossible to accurately define terminal fishing mortality (F_t) because of the sensitivity of sequential population analysis to input F.

A similar exercise involved the calculation of catchability coefficients using three different F_t values for each of the two stock areas (Table 25). The catchability coefficients were calculated by dividing the normalized catch rate by the estimate of exploitable biomass (5+). The aim was to determine a F_t which would give a stable catchability coefficient over the time series. Once again it was impossible to accurately define F_t other than to suggest it was low for each stock area.

Total mortality rates were then estimated from catch curves derived for each stock area (Tables 26 and Fig. 11). Only commercial gillnet catches of 1969 yearclass fish and older and total gillnet effort were considered over the time series. Results showed a very low total mortality for White Bay-Notre Dame Bay (Z = 0.17) from 1977-84. For Bonavista Bay-Trinity Bay, Z = 0.27 from 1979-84. Since total mortality estimates were extremely low, it was impossible to accurately estimate fishing mortality for either area.

3) Calculation of Stock Biomass from Acoustic Surveys

A relationship was calculated (Fig. 12) between the area (length x depth) of schools as measured from the depth sounder and weight per school (kg) as estimated by vessel master from purse seine sets during the 1984 acoustic survey. Only those sets in shallow water (< 30 m), where it was considered likely that the entire school was caught, were considered in determining this relationship. Stock biomasses were then determined (Table 27) from acoustic surveys conducted in 1983 and 1984. An estimate of m^2 of schools observed was determined from length and depth measurements of all schools recorded on the depth sounder during the survey. This was considered to be a conservative estimate as not all schools observed by sonar were recorded on the sounder. An estimate of average school dimensions (m^2) was derived from total m^2 and number of schools observed. An estimate of tons/school and hence total tons observed was derived from the estimates of average school dimensions and the relationship in Figure 12. The estimates of tons observed were then converted to densities based on the area surveyed as determined from the estimate of distance travelled (Table 8) and cruise track width (0.30 km). The cruise track width was estimated as the distance covered by a sweep of the sonar as set during the acoustic survey. Total biomass (t) within 0-90 m of the area surveyed was calculated by prorating the density estimates by areal expansion. Since a significant number of schools were observed outside the 90 m contour, the biomass estimates are considered to be conservative. Since White Bay was not surveyed, the biomass estimate for the White Bay-Notre Dame Bay stock complex was determined by prorating the Notre Dame Bay estimate using information on relative seasonal stock size from tagging studies (Wheeler and Winters 1984a). Biomass estimates for Bonavista Bay and Trinity Bay in 1984 were combined to give total biomass for that stock complex and the 1984 ratio between Bonavista Bay and Trinity Bay biomasses was used to prorate the 1983 biomass estimate which was for Bonavista Bay only.

Assessment Results

1. Population Numbers at age:

Total population numbers were obtained for White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay from biomass estimates calculated from acoustic surveys as described above and from the mean weights of fish sampled during the surveys (Table 28). Population numbers at age were obtained by applying the weighted age composition of the population derived the acoustic surveys to the total population numbers. These numbers at age were then used to represent populations in October 1983 and 1984. Similar biomass estimates were not available for Conception Bay-Southern Shore as there were no acoustic surveys in the area. Instead the strength of the 1982 yearclass for this area was based upon a comparison of the 1982 yearclass to the 1968 yearclass for the areas acoustically surveyed both along the east coast and southeast coast (Wheeler and Dalley 1985). These comparisons (Table 29) were determined from cohort analyses initiated with the empirical population age structures, back-calculated to the beginning of 1984, as derived from the 1984 acoustic survey.

A north-south cline existed in the relationship of the two yearclasses for the acoustically surveyed areas: a value of 0.45 was chosen to estimate the 1982 yearclass in relation to that of 1968 for Conception Bay-Southern Shore. Cohort analyses were conducted for Conception Bay-Southern Shore to derive an estimate of F_t (0.018) which when combined with the partial recruitment pattern derived from the survey provided this relationship (0.45) between the two yearclasses and stock size estimates at age for 1984. Similarly cohort analyses were conducted to derive estimates of F_t for White Bay-Notre Dame Bay (0.050) and Bonavista Bay-Trinity Bay (0.011) which best approximated empirical 1984 population age structures derived from the acoustic survey.

2) Trends in Biomass and Fishing Mortality:

In all areas, 2+ biomass levels have increased substantially with the recruitment of the 1982 yearclass (Tables 30-32). In White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay, B_2+ has increased approximately 50% from 1983. In Conception Bay-Southern Shore, the increase has been greater, approximately 137%. In all areas, the present 2+ biomass is approximately 21-23% of maximum historical levels.

As a result of the recruitment of the 1979 yearclass, 5+ biomass levels have decreased slightly from 1983 to 1984 in White Bay-Notre Dame Bay, increased slightly in Bonavista Bay-Trinity Bay, and more than doubled (2.01) in Conception Bay-Southern Shore. Similar trends were evident in the commercial and research age compositions (Fig. 9-10) which showed increased percentages of five-year-olds (1979 yearclass) in southern areas.

Fishing mortality (5+) estimates were low and showed the same trends for all areas, peaking in 1978 or 1979 and declining ever since. This decline is as expected with reduced TAC's in the early 1980's and closure of the fishery in 1983. Fishing mortality rates have exceeded $F_{0.1}$ = 0.30 only once in one area (Conception Bay-Southern Shore) over the time series suggesting that stock declines have been mainly due to recruitment failure of yearclasses produced during the 1970's rather than excessive fisning pressure.

3) Trends in Recruitment:

As shown before (Table 29), recruitment estimates of the 1982 yearclass from the acoustic survey suggest that this yearclass is strong, approximately 70% that of the 1968 yearclass at age 2 in White Bay-Notre Dame Bay, 50% in Bonavista Bay-Trinity Bay, and 45% in Conception Bay-Southern Shore. This also agrees with the age composition of samples from the research gillnet program in 1984 (Fig. 10).

Although the 1979 yearclass shows increasing dominance in commercial catches, it is not strong in any area and is presently 5% the size of the 1968 yearclass (at age 5) in White Bay-Notre Dame Bay, 6% that of the 1968 yearclass in Bonavista Bay-Trinity Bay, and 5% in Conception Bay-Southern Snore. It should be noted, however, that these percentages represent spring spawners only and that from commercial and research gillnet age compositions (Fig. 9 and 10) it appears that approximately 30-50% of the 1979 yearclass are autumn spawners.

Other recent yearclasses (1980 and 1981) appear to be very poor in most areas. There is one possible exception; the 1980 yearclass in Conception Bay-Southern Snore is approximately 80% of the size of the 1979 yearclass and thus 3% of the size of the 1968 yearclass at age 4.

Prognoses

1) Catch Projections:

The population vectors for White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay derived from the acoustic survey (Table 28) and that for Conception Bay-Southern Shore derived from cohort analysis (Table 32) were projected to 1986 assuming the following catches in 1985: 2000 t in White Bay-Notre Dame Bay, 800 t in Bonavista Bay-Trinity Bay, and 200 t in Conception Bay-Southern Shore. These catches were assumed reasonable as there has been a 1500 t TAC allocated for the spring fishery and a similar TAC is anticipated for the fall fishery in 1985. The population vectors, used to initiate the projections in 1985, were corrected to allow for natural mortality from the time of the acoustic survey to the beginning of 1985. Mean weights at age were those derived from samples collected in 1984 (Table 9). $F_{0.1}$ was assumed to be 0.30. Recruitment at age 2 in 1986 was

assumed to equal the average recruitment of the 1970-81 yearclasses (i.e. excluding the large 1968 and 1982 yearclasses). These recruitment values were as follows:

	White Bay-Notre Dame Bay	Bonavista Bay-Trinity Bay	Conception Bay-Southern Shore
R ($x10^3$)	10,000	5,000	500

Two options of partial recruitment patterns were used in the projections (Table 33), one based upon historical combined purse seine and gillnet fisheries (Winters and Moores 1977) and the second for a gillnet fishery only (Wheeler et al. 1984). These projections (Tables 34-36) show catches for 1986 of approximately 33,000 t for a combined purse seine and gillnet fishery and 25,000 t for a gillnet fishery only.

2) Management Implications:

These projections are based entirely upon population estimates derived from acoustic surveys. Although such estimates are independent of the commercial fishery, they are still very preliminary in nature as this survey concept is new and hence the techniques require continuing refinement. However, initial observations suggest that such surveys offer excellent potential for independent estimates of stock size. Furthermore, throughout all calculations, attempts have been made to choose conservative parameters wherever possible.

For these herring stocks, at the northernmost edge of their range, strong recruitment tends to be very sporadic, 14 years between the 1968 and 1982 yearclasses. Illustrative projections have been made to 1990 for each stock area (Tables 37-39) assuming no strong recruitment during that time. Projections have been made using the population vectors derived from the acoustic survey for White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay and that derived from cohort analysis for Conception Bay-Southern Shore. Recruitment was assumed to be equal to the historical geometric mean, 36.2×10^6 for White Bay-Notre Dame Bay, 19.6×10^6 for Bonavista Bay-Trinity Bay, and 3.2×10^6 for Conception Bay-Southern Shore. Partial recruitment values were for a combined purse seine and gillnet fishery (Table 33). To compensate for sporadic strong recruitment, projections have been made assuming two levels of fishing mortality, $F = 0.30$ and $F = 0.20$. Results show that with average recruitment within six to eight years, stock biomass will decline to levels observed prior to the recruitment of the 1982 yearclass, even at $F = 0.20$.

The short-term future of the east coast Newfoundland herring stocks looks secure with the recruitment of the 1982 yearclass. However, the long-term future will depend both upon management strategies and recruitment success within the next several years. From a biological point of view, fisheries should be conducted on or near the spawning grounds. Fall

fisheries, which exploit mixed stocks, have the potential to destroy a particular spawning group. Spring fisheries on or near the spawning ground, if regulated properly, will ensure continued viability of all spawning stock components. However, should such a management strategy be adopted, it may be necessary to redefine stock delineation as presented in this assessment.

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Table 1. White Bay (W.B.) - Notre Dame Bay (N.D.B.) herring landings (t), by gear, 1973-84.

Year	Area	Gear						Total
		Purse seine	Ringnet	Midwater trawl	Bar seine	Gillnet	Trap	
1973	W.B.	1	-	-	35	552	229	817
	N.D.B.	1	-	-	20	1533	105	1659
	Combined	2	-	-	55	2085	334	2476
1974	W.B.	-	8	11	53	738	632	1442
	N.D.B.	-	6	-	85	2191	312	2594
	Combined	-	14	11	138	2929	944	4036
1975	W.B.	828	-	-	46	1209	329	2412
	N.D.B.	1183	108	-	12	1631	209	3143
	Combined	2011	108	-	58	2840	538	5555
1976	W.B.	1724	487	-	18	509	246	2984
	N.D.B.	2908	3412	-	589	2242	353	9504
	Combined	4632	3899	-	607	2751	599	12488
1977	W.B.	-	1228	-	39	268	240	1775
	N.D.B.	-	4961	-	2096	2438	355	9850
	Combined	-	6189	-	2135	2706	595	11625
1978	W.B.	-	1254	-	240	1133	331	2958
	N.D.B.	-	3980	-	306	5859	311	10456
	Combined	-	5234	-	546	6992	642	13414
1979	W.B.	-	832	-	9	978	64	1883
	N.D.B.	-	1968	-	2274	8971	598	13811
	Combined	-	2800	-	2283	9949	662	15694
1980	W.B.	-	747	-	-	1269	83	2099
	N.D.B.	-	913	-	727	2778	13	4431
	Combined	-	1660	-	727	4047	96	6530
1981	W.B.	-	220	-	14	646	23	903
	N.D.B.	-	1065	-	400	2209	107	3781
	Combined	-	1285	-	414	2855	130	4684
1982	W.B.	-	-	-	7	402	52	461
	N.D.B.	-	-	-	136	1425	1	1562
	Combined	-	-	-	143	1827	53	2023
1983	W.B.	-	15	-	-	76	7	98
	N.D.B.	-	-	-	-	329	-	329
	Combined	-	15	-	-	406	7	427
1984*	W.B.	-	-	-	5	313	4	322
	N.D.B.	-	-	-	3	715	-	718
	Combined	-	-	-	8	1028	4	1040

* provisional

Table 2. Bonavista Bay (B.B.) - Trinity Bay (T.B.) herring landings (t), by gear, 1973-84.

Year	Area	Gear						Total
		Purse seine	Ringnet	Midwater trawl	Bar seine	Gillnet	Trap	
1973	B.B.	5	-	-	23	479	2	509
	T.B.	156	-	-	199	340	5	700
	Combined	161	-	-	222	819	7	1209
1974	B.B.	-	-	-	21	611	10	642
	T.B.	-	428	-	154	976	93	1651
	Combined	-	428	-	175	1587	103	2293
1975	B.B.	1559	-	-	34	414	2	2009
	T.B.	1370	1790	-	242	411	90	3903
	Combined	2929	1790	-	276	825	92	5912
1976	B.B.	2812	3052	-	24	328	139	6355
	T.B.	1614	1054	-	465	419	30	3582
	Combined	4426	4106	-	489	747	169	9937
1977	B.B.	-	6223	236	2495	309	-	9263
	T.B.	-	1548	-	927	174	45	2694
	Combined	-	7771	236	3422	483	45	11957
1978	B.B.	-	4239	-	150	1320	3	5712
	T.B.	-	1055	-	966	308	8	2337
	Combined	-	5294	-	1116	1628	11	8049
1979	B.B.	-	3490	-	377	2374	4	6245
	T.B.	-	1181	-	1615	680	55	3531
	Combined	-	4671	-	1992	3054	59	9776
1980	B.B.	-	1714	-	652	1321	-	3687
	T.B.	-	964	-	405	336	13	1718
	Combined	-	2678	-	1057	1657	13	5405
1981	B.B.	-	1100	-	713	1399	7	3219
	T.B.	-	78	-	361	367	19	825
	Combined	-	1178	-	1074	1766	26	4044
1982	B.B.	-	-	-	-	386	4	390
	T.B.	-	-	-	25	76	6	107
	Combined	-	-	-	25	462	10	497
1983	B.B.	-	-	-	-	52	-	52
	T.B.	-	-	-	27	17	-	44
	Combined	-	-	-	27	69	-	96
1984*	B.B	-	-	-	-	136	-	136
	T.B.	-	-	-	-	42	-	42
	Combined	-	-	-	-	178	-	178

* provisional

Table 3. Conception Bay (C.B.) - Southern Shore (S.S.) herring landings (t), by gear, 1973-1984.

Year	Area	Gear						
		Purse seine	Ringnet	Midwater trawl	Bar seine	Gillnet	Trap	Total
1973	C.B.	211	-	-	491	181	83	966
	S.S.	18	-	-	157	170	-	345
	Combined	229	-	-	648	351	83	1311
1974	C.B.	48	2107	-	67	131	134	2487
	S.S.	-	32	-	14	72	86	204
	Combined	48	2139	-	81	203	220	2691
1975	C.B.	13	2281	-	388	166	24	2872
	S.S.	315	-	-	23	160	169	667
	Combined	328	2281	-	411	326	193	3539
1976	C.B.	-	1704	258	76	153	92	2283
	S.S.	-	44	-	-	8	149	201
	Combined	-	1748	258	76	161	241	2484
1977	C.B.	-	1248	-	58	174	12	1492
	S.S.	-	442	-	-	18	200	660
	Combined	-	1690	-	58	192	212	2152
1978	C.B.	-	1098	-	11	415	3	1527
	S.S.	-	133	-	14	78	193	418
	Combined	-	1231	-	25	493	196	1945
1979	C.B.	-	432	-	-	210	63	705
	S.S.	-	10	-	18	49	111	188
	Combined	-	442	-	18	259	174	893
1980	C.B.	-	319	-	16	107	1	443
	S.S.	-	-	-	-	2	32	34
	Combined	-	319	-	16	109	33	477
1981	C.B.	-	-	-	-	160	2	162
	S.S.	-	-	-	-	53	8	61
	Combined	-	-	-	-	213	10	223
1982	C.B.	-	-	-	-	84	1	85
	S.S.	-	-	-	-	7	5	12
	Combined	-	-	-	-	91	6	97
1983	C.B.	-	-	-	-	17	-	17
	S.S.	-	-	-	-	-	-	-
	Combined	-	-	-	-	17	-	17
1984*	C.B.	-	-	-	-	49	-	49
	S.S.	-	-	-	-	-	-	-
	Combined	-	-	-	-	49	-	49

* provisional

Table 4. Number of fish sampled from the northeast Newfoundland herring fishery, by area and gear, 1980-84 (research samples in parentheses).

Year	Area	Gear type				Total sampled	Comm. catch (t)
		Trap	Bar seine	Gillnet	Ringnet		
1980	WB	-	-	191(1325)	-	191(1325)	2099
	NDB	(100)	400	735(1300)	(100)	1135(1500)	4431
	BB	-	650	100 (950)	1462	2212 (950)	3687
	TB	-	650	149 (573)	788	1587 (573)	1718
	CB	-	-	100 (48)	294	394 (48)	443
	SS	-	-	-	-	-	34
	TTL.	(100)	1700	1275(4196)	2544 (100)	5519(4396)	12412
1981	WB	-	-	(598)	-	(598)	903
	NDB	-	498	549(1576)	1369	2416(1576)	3781
	BB	-	450(150)	450 (731)	1545 (550)	2445(1431)	3219
	TB	-	398	200 (400)	350	948 (400)	825
	CB	-	-	-	-	-	162
	SS	-	-	-	-	-	61
	TTL.	-	1346(150)	1199(3305)	3264 (550)	5809(4005)	8951
1982	WB	196	-	(1133)	-	196(1133)	461
	NDB	-	150	1000	(1022)	1150(1022)	1562
	BB	-	-	850(1378)	(2202)	850(3580)	390
	TB	-	-	10 (381)	-	10 (381)	107
	CB	-	-	100	-	100	85
	SS	-	-	-	-	-	12
	TTL.	196	150	1960(2892)	(3224)	2306(6116)	2617
1983	WB	-	63	376 (799)	22	461 (799)	98
	NDB	-	-	(1230)	200(2927)	200(4157)	330
	BB	700	-	645(1210)	(2065)	1345(3275)	54
	TB	527	-	548 (678)	(700)	1075(1378)	44
	CB	326	-	50 (145)	(450)	376 (595)	17
	SS	150	-	-	-	150	-
	TTL.	1703	63	1619(4062)	222(6142)	3607(10204)	543
1984	WB	121	-	513(1207)	-	634(1207)	322
	NDB	-	50	994(1150)	(664)	1044(1814)	718
	BB	-	-	550(1860)	(844)	550(2704)	136
	TB	150	(100)	200 (800)	(700)	350(1600)	42
	CB	(100)	-	50 (400)	(464)	50 (964)	49
	SS	-	-	-	-	-	-
	TTL.	271 (100)	50(100)	2307(5417)	(2672)	2628(8289)	1267

Table 5. Commercial catch at age for White Bay - Notre Dame Bay, 1966-1984.

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	1	86	1	1	10	1	5	1	1	2
3	40	43	64	54	1	303	292	728	5	128
4	2	1551	1	103	13	51	2448	1494	119	216
5	27	86	718	19	24	159	362	2928	3177	460
6	67	43	11	1155	25	57	70	775	5523	5458
7	180	1	48	1	988	431	126	734	1198	7090
8	128	86	161	108	11	10134	408	663	705	1123
9	23	1	295	9	86	235	1391	419	1511	836
10	6	1	188	59	161	278	208	1695	861	809
11	75	6	1	27	167	1139	67	162	1595	1072
12	1	80	6	1	76	1181	275	52	152	1986
13	1	1	84	1	3	537	285	214	49	189
14	1	1	1	12	3	21	130	222	201	61
15	1	1	1	1	34	21	5	101	209	250
16	1	1	1	1	1	240	5	4	95	260
17	1	1	1	1	1	1	58	4	4	118
18	1	1	1	1	1	1	1	45	4	5
19	1	1	1	1	1	1	1	1	42	5
20	1	1	1	1	1	1	1	1	1	52

AGE	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	121	52	1	1	115	445	76	1	6
3	32	1704	55	53	46	152	371	38	12
4	611	109	2041	712	1240	41	332	46	96
5	245	468	318	869	92	1231	59	23	732
6	815	184	1037	647	1080	63	268	14	57
7	10280	795	518	1049	17	805	34	93	88
8	16377	7391	2514	2097	496	64	258	1	101
9	1295	12697	10820	6606	179	344	19	26	32
10	3304	1055	11773	14213	1449	194	192	4	93
11	1391	4488	906	11164	5335	982	71	36	7
12	1843	1890	3854	859	4191	3614	359	13	63
13	3414	2504	1623	3655	322	2839	1312	68	23
14	325	4638	2150	1539	1372	218	1038	249	119
15	105	441	3983	2039	578	929	80	197	435
16	430	143	379	3777	765	392	340	15	345
17	447	584	123	359	1418	518	143	65	26
18	203	607	502	117	135	961	189	27	114
19	9	276	521	476	44	91	351	36	47
20	98	145	362	837	493	364	166	98	63

Table 6. Commercial catch at age for Bonavista Bay - Trinity Bay, 1966-1984.

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	1	35	1	1	1	1	1	1	1	1
3	33	17	42	6	1	416	10	2	1	396
4	15	628	1	4	10	226	1354	78	2	136
5	9	35	469	10	10	21	390	3632	236	164
6	83	17	7	332	57	18	91	380	4848	2577
7	96	1	32	4	867	200	76	63	440	14373
8	179	35	105	52	37	1042	90	80	152	456
9	32	1	193	27	135	129	486	107	301	1002
10	40	1	123	38	74	128	14	756	69	729
11	300	4	2	197	26	69	68	15	581	139
12	1	31	7	3	135	24	37	73	12	1170
13	1	1	52	11	2	125	13	40	56	24
14	1	1	1	83	8	2	66	14	31	113
15	1	1	1	1	57	7	1	71	11	62
16	1	1	1	1	1	53	4	1	55	22
17	1	1	1	1	1	1	28	4	1	111
18	1	1	1	1	1	1	1	30	3	2
19	1	1	1	1	1	1	1	1	23	6
20	1	1	1	1	1	1	1	1	1	46

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	14	17	22	6	15	136	1	1	4
3	77	248	26	286	13	246	8	4	22
4	495	135	358	167	195	53	11	34	35
5	122	762	115	763	43	256	2	7	212
6	167	227	242	19	294	26	30	2	10
7	4936	50	112	433	52	288	5	15	5
8	20812	6202	588	101	264	23	35	1	12
9	912	23061	4275	503	75	321	5	8	2
10	860	952	13035	5565	967	88	65	2	2
11	1303	966	790	13898	2680	860	9	8	2
12	248	1463	801	841	6693	2383	86	1	8
13	2092	279	1214	853	405	5952	239	11	1
14	43	2349	231	1292	411	360	596	30	11
15	202	48	1949	246	622	366	36	76	28
16	111	227	40	2075	118	553	37	5	73
17	39	125	188	43	999	105	55	5	5
18	198	44	104	200	21	888	11	7	5
19	4	222	37	111	96	19	89	1	7
20	93	109	275	332	213	275	29	15	1

Table 7. Commercial catch at age for Conception Bay - Southern Shore, 1966-1984.

Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	1	4	1	1	1	1	1	68	3	13
3	23	2	2	13	1	10	7	1	1	424
4	5	67	1	3	17	31	1625	23	5	30
5	1	4	17	2	20	13	135	4525	130	16
6	19	2	1	65	24	8	55	264	9544	2055
7	20	1	1	2	290	41	29	469	150	8816
8	125	4	4	1	14	308	79	136	75	116
9	28	1	7	1	15	33	359	40	40	492
10	1	1	5	2	12	13	67	188	13	256
11	126	1	1	3	14	10	22	8	584	17
12	1	4	1	1	20	12	17	3	25	773
13	1	1	1	1	7	17	21	2	9	33
14	1	1	1	1	7	6	29	3	6	12
15	1	1	1	1	7	6	10	4	9	8
16	1	1	1	1	1	6	10	1	12	12
17	1	1	1	1	1	1	10	1	3	16
18	1	1	1	1	1	1	1	1	3	4
19	1	1	1	1	1	1	1	1	3	4
20	1	1	1	1	1	1	1	1	1	4

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	1046	7	1	1	1	1	1	1	1
3	15	132	1	4	1	25	2	1	3
4	85	5	99	9	3	4	5	1	27
5	22	101	32	34	1	26	1	1	48
6	28	45	65	7	19	9	2	1	5
7	2364	13	14	38	1	28	1	1	1
8	4779	950	3	4	12	3	5	1	2
9	73	4260	735	31	1	14	1	1	1
10	226	49	3084	272	49	13	1	1	1
11	157	236	65	1144	156	21	4	1	1
12	10	164	315	24	656	68	7	1	1
13	475	10	219	117	14	288	23	1	1
14	20	496	13	81	67	6	98	2	1
15	7	21	663	5	46	29	2	7	3
16	5	7	28	246	3	20	10	1	1
17	7	5	9	10	141	1	7	1	1
18	10	7	7	3	6	62	1	1	1
19	2	10	9	3	2	3	21	1	1
20	5	7	23	12	9	5	3	2	1

Table 8. East coast Newfoundland acoustic purse seine survey parameters, 1982-84.

Area	Year	Schools	m^2 Schools	km	Hours
N.D.B.	1982	?	?	?	?
	1983	252	146556	968	116.25
	1984	595	197163	738	114.75
B.B.	1982	?	?	?	?
	1983	210	90850	631	103.25
	1984	850	203413	946	135.50
T.B.	1984	512	237608	802	112.25

Table 9. Mean weight at age (g) of east coast Newfoundland herring from samples collected in quarters 1-2 (White Bay-Notre Dame Bay and Bonavista Bay-Trinity Bay) and in quarters 1-4 (Conception Bay-Southern Shore).

	Area		
Age	White Bay-Notre Dame Bay	Bonavista Bay-Trinity Bay	Conception Bay-Southern Shore
2	60	53	71
3	150	130	181
4	252	193	259
5	241	241	292
6	343	289	358
7	305	315	348
8	357	328	364
9	367	333	390
10	398	342	425
11+	383	387	467

Table 10. Abundance indices derived from east coast Newfoundland acoustic purse seine surveys, 1982-84.

Area	Year	Schools per km	Schools per hr	m^2 Schools per km	m^2 Schools per hr	Avg. Length	Avg. Depth
NDB	1982	?	?	?	?	?	?
	1983	0.260	2.168	151	1261	51.8	10.1
	1984	0.806	5.185	267	1718	36.3	8.5
BB	1982	?	?	?	?	?	?
	1983	0.333	2.034	144	880	43.0	8.8
	1984	0.899	6.273	215	1501	28.7	5.8
COMB	1982	?	?	?	?	?	?
	1983	0.289	2.105	148	1082	47.9	9.4
	1984	0.858	5.774	239	1601	31.7	7.0

Table 11. Total catch (number of fish), number of days hauled and number of days fished, by community, for research gillnet program, White Bay - Notre Dame Bay (* indicate shallow nets).

Year	Community								
	Croque			Westport			Brents Cove		
	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished
1980	-	-	-	2132*	39	54	-	-	-
1981	-	-	-	1031*	21	36	-	-	-
1982	-	-	-	2354*	23	29	19866	17	28
1983	-	-	-	6988	25	30	17410	11	13
1984	1486	19	25	11112	25	31	47300	16	31
	La Scie			Harry's Harbour			Leading Tickles		
	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished
1980	6275*	18	29	-	-	-	-	-	-
1981	4262	14	24	2395	18	29	2849	13	26
1982	-	-	-	-	-	-	-	-	-
1983	-	-	-	34127	25	32	10637	18	28
1984	-	-	-	4880	24	33	10360	18	30
	Hillgrade			Herring Neck					
	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished			
1980	38168*	36	58	-	-	-			
1981	2749*	15	33	-	-	-			
1982	0*	17	31	-	-	-			
1983	285	24	30	-	-	-			
1984	-	-	-	7900	23	30			

Table 12. Total catch (number of fish), number of days hauled and number of days fished, by community, for research gillnet program, Bonavista Bay - Trinity Bay (* indicate shallow nets).

Year	Centreville			Salvage			Portland		
	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished
1980	989*	33	51	4216*	22	32	-	-	-
1981	829*	23	30	230*	24	35	6734	16	27
1982	1369	18	24	10187	14	24	3059	9	30
1983	1430	25	29	19639	19	27	-	-	-
1984	1754	23	30	11656	18	31	-	-	-

Year	Charlottetown			Port Rexton			Hickmans Harbour		
	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished	Total catch	Days hauled	Days fished
1980	-	-	-	-	-	-	2143*	31	48
1981	-	-	-	-	-	-	81*	26	30
1982	-	-	-	1698	24	30	154	25	30
1983	8728	23	31	13435	23	31	-	-	-
1984	5578	15	31	6243	27	32	-	-	-0

Year	Long Beach		
	Total catch	Days hauled	Days fished
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	695	18	27
1984	5205	22	33

Table 13. Total catch (number of fish), number of days hauled and number of days fished, by community, for research gillnet program, Conception Bay - Southern Shore.

Year	Community		
	Bay Roberts		
	Total catch	Days hauled	Days fished
1980	-	-	-
1981	-	-	-
1982	-	-	-
1983	2434	12	29
1984	22289	24	32

Table 14. Comparative catch rates of shallow vs deep research gillnets, where total days fished is the same for both type nets.

Area	Community		No. caught per net 2"	2 1/4"	2 1/2"	2 3/4"	3"	Total caught	Conversion factor
White Bay	Westport	S	723	1027	1679	861	217	4507	1.55
	(Oct. '83)	D	1020	1691	2945	1007	325	6988	
Notre Dame Bay	Hillgrade	S	15	22	12	9	1	59	4.83
	(Oct. '83)	D	68	72	123	22	0	285	
Bonavista Bay	Salvage	S	436	795	710	418	166	2525	7.78
	(Oct. '83)	D	1755	4662	6745	4967	1510	19639	
Bonavista Bay	Newman Sd.	S	57	73	114	93	26	363	1.08
	(May '84)	D	68	64	93	109	57	391	
Bonavista Bay	Newman Sd.	S	39	50	16	15	0	120	1.98
	(Aug. '84)	D	38	57	79	47	17	238	
Combined		S	1270	1967	2531	1396	410	7574	3.64*
		D	2949	6546	9985	6152	1909	27541	3.44**

* weighted conversion factor
** unweighted conversion factor

Table 15. CPUE indices (total number of herring caught per fishing day) for research gillnet program, White Bay - Notre Dame Bay (* catch rates adjusted by 3.50 where necessary to account for shallow nets).

Year	Community							
	Croque		Westport		Brents Cove		La Scie	
	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished
1980	-	-	138*	54	-	-	757*	29
1981	-	-	100*	36	-	-	178	24
1982	-	-	284*	29	710	28	-	-
1983	-	-	233	30	1339	13	-	-
1984	59	25	358	31	1526	31	-	-
	Harry's Hr.		Leading Tickles		Hillgrade		Herring Neck	
	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished
1980	-	-	-	-	2303*	58	-	-
1981	83	29	110	26	292*	33	-	-
1982	-	-	-	-	0*	31	-	-
1983	1066	32	380	28	10	30	-	-
1984	148	33	345	30	-	-	263	30

	Combined			
	Catch rate		Days fished	
	Avg. 1	Avg. 2	Avg. 1	Avg. 2
1980	138	1156	54	141
1981	100	154	36	148
1982	284	319	29	88
1983	233	522	30	133
1984	358	461	31	180

1) weighted averages: communities consistent over five years
2) weighted averages: all communities

Table 16. CPUE indices (total number of herring caught per fishing day) for research gillnet program, Bonavista Bay - Trinity Bay (* catch rates adjusted by 3.50 where necessary to account for shallow nets).

Year	Community							
	Centreville		Salvage		Portland		Charlottetown	
	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished
1980	68*	51	461*	32	-	-	-	-
1981	97*	30	23*	35	249	27	-	-
1982	57	24	424	24	102	30	-	-
1983	49	29	727	27	-	-	282	31
1984	58	30	376	31	-	-	180	31

	Port Rexton		Hickmans Hr.		Long Beach	
	Catch rate	Days fished	Catch rate	Days fished	Catch rate	Days fished
1980	-	-	156*	48	-	-
1981	-	-	9*	30	-	-
1982	57	30	5	30	-	-
1983	433	31	-	-	26	27
1984	195	32	-	-	158	33

	Combined			
	Catch rate		Days fished	
	Avg. 1	Avg. 2	Avg. 1	Avg. 2
1980	219	196	83	131
1981	57	88	65	122
1982	241	119	48	138
1983	376	303	56	145
1984	220	194	61	157

1) weighted averages: communities consistent over five years
2) weighted averages: all communities

Table 17. CPUE indices (total number of herring caught per fishing day) for research gillnet program, Conception Bay - Southern Shore.

Year	Community	
	Bay Roberts	
	Catch rate	Days fished
1980	-	-
1981	-	-
1982	-	-
1983	84	29
1984	697	32

Table 18. CPUE indices (total number of herring caught per days hauled) for research gillnet program, White Bay - Notre Dame Bay (* catch rates adjusted by 3.50 where necessary to account for shallow nets).

Year	Croque		Westport		Brents Cove		La Scie	
	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled
1980	-	-	191*	39	-	-	1220*	18
1981	-	-	172*	21	-	-	304	14
1982	-	-	358*	23	1169	17	-	-
1983	-	-	280	25	1583	11	-	-
1984	78	19	444	25	2956	16	-	-

Year	Harry's Hr.		Leading Tickles		Hillgrade		Herring Neck	
	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled
1980	-	-	-	-	3711*	36	-	-
1981	133	18	219	13	641*	15	-	-
1982	-	-	-	-	0*	17	-	-
1983	1365	25	591	18	12	24	-	-
1984	203	24	576	18	-	-	343	23

Year	Combined			
	Catch rate		Days hauled	
	Avg. 1	Avg. 2	Avg. 1	Avg. 2
1980	191	1753	39	93
1981	172	281	21	81
1982	358	493	23	57
1983	280	674	25	103
1984	444	664	25	125

1) weighted averages: communities consistent over five years
2) weighted averages: all communities

Table 19. CPUE indices (total number of herring caught per days hauled) for research gillnet program, Bonavista Bay - Trinity Bay, catch rates adjusted by 3.50 where necessary to account for shallow nets).

Year	Centreville		Salvage		Portland		Charlottetown	
	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled
1980	105*	33	671*	22	-	-	-	-
1981	126*	23	34*	24	421	16	-	-
1982	76	18	728	14	340	9	-	-
1983	57	25	1034	19	-	-	379	23
1984	76	23	648	18	-	-	372	15

Year	Port Rexton		Hickmans Hr.		Long Beach	
	Catch rate	Days hauled	Catch rate	Days hauled	Catch rate	Days hauled
1980	-	-	242*	31	-	-
1981	-	-	11*	26	-	-
1982	71	24	6	25	-	-
1983	584	23	-	-	39	18
1984	231	27	-	-	237	22

Year	Combined			
	Catch rate		Days hauled	
	Avg. 1	Avg. 2	Avg. 1	Avg. 2
1980	331	299	55	86
1981	79	120	47	89
1982	361	183	32	90
1983	479	407	44	108
1984	327	290	41	105

1) weighted averages: communities consistent over five years
2) weighted averages: all communities

Table 20. CPUE indices (total number of herring caught per days hauled) for research gillnet program, Conception Bay - Southern Shore.

Year	Community	
	Bay Roberts	
	Catch rate	Days hauled
1980	-	-
1981	-	-
1982	-	-
1983	203	12
1984	929	24

Table 21. Normalized gillnet (commercial and 2 1/2", 2 3/4" research) catch rate time series.

	Year							
	1977	1978	1979	1980	1981	1982	1983	1984
White Bay-Notre Dame Bay								
COMMERCIAL								
kg/net/ldg.	70	58	51	39	56	58	-	-
mean wgt. (kg)	.280	.295	.310	.330	.355	.355	-	-
#/net/ldg.	250	197	165	118	158	164	-	-
normalized	1.70	1.34	1.13	0.80	1.08	1.12	-	-
RESEARCH								
#/2 nets/d.h.	-	-	-	903	158	317	434	298
#/net/d.h.	-	-	-	452	79	159	217	149
log e	-	-	-	6.11	4.37	5.07	5.38	5.00
normalized	-	-	-	1.18	0.84	0.98	1.04	0.96
COMBINED								
normalized	1.70	1.34	1.13	0.99	0.96	1.05	1.04	0.96
Bonavista Bay-Trinity Bay								
COMMERCIAL								
kg/net/ldg.	-	-	102	71	54	73	-	-
mean wgt. (kg)	-	-	.335	.365	.360	.400	-	-
#/net/ldg.	-	-	304	195	150	183	-	-
normalized	-	-	1.73	1.11	0.85	1.04	-	-
RESEARCH								
#/2 nets/d.h.	-	-	-	176	79	98	256	153
#/net/d.h.	-	-	-	88	40	49	128	77
log e	-	-	-	4.48	3.69	3.89	4.85	4.34
normalized	-	-	-	1.11	0.92	0.97	1.21	1.08
COMBINED								
normalized	-	-	1.73	1.11	0.89	1.01	1.21	1.08

Table 22. Calculation of partial recruitment pattern from acoustic purse seine survey abundance index (P.S.A.I.) and commercial catch at age (C.C.A.).

Area	Age	Acoustic abundance index		Commercial catch at age		C.C.A.	
		m^2	%	#	%	P.S.A.I.	P.R.
White Bay-Notre Dame Bay							
	2	113,147	76.3	6	0.2	0.003	0.001
	3	950	0.6	12	0.5	0.833	0.101
	4	805	0.5	96	3.9	7.800	0.942
	5	5,334	3.6	732	29.8	8.278	1.000
	6	1,153	0.8	57	2.3	2.875	0.347
	7	876	0.6	88	3.6	6.000	0.725
	8	2,198	1.5	101	4.1	2.733	0.330
	9	-	-	32	1.3	-	-
	10	468	0.3	93	3.8	12.667	1.000
	11+	23,299	15.7	1,242	50.5	3.217	0.389
Bonavista Bay-Trinity Bay							
	2	308,841	80.4	4	0.9	0.011	0.001
	3	3,081	0.8	22	4.9	6.125	0.557
	4	7,540	2.0	35	7.9	3.950	0.359
	5	27,778	7.2	212	47.6	6.611	0.601
	6	851	0.2	10	2.2	11.000	1.000
	7	707	0.2	5	1.1	5.500	0.500
	8	780	0.2	12	2.7	13.500	1.000
	9	669	0.2	2	0.4	2.000	0.182
	10	3,048	0.8	2	0.4	0.500	0.045
	11+	30,712	8.0	141	31.7	3.963	0.360

Table 23. Calculation of instantaneous total mortality (Z) from research gillnet program, where F is number of days fished.

Area	Community	Z3+ 1980-81	1981-82	1982-83	1983-84	1982-84
WB/ NDB	Croque	-	-	-	-	-
	Westport	0.48	-0.84	1.16	-0.66	0.01
	Brents Cove	-	-	-0.59	-0.49	-1.07
	La Scie	1.47	-	-	-	-
	Harry's Harbour	-	-	-	2.11	-
	Leading Tickles	-	-	-	0.08	-
	Hillgrade	2.14	-	-	-	-
	Herring Neck	-	-	-	-	-
	Combined (1)	0.48	-0.84	1.16	-0.66	0.01
	(2)	2.11	-0.67	-0.38	0.10	-0.33
BB/ TB	Centreville	-0.27	0.81	0.12	-0.10	0.08
	Salvage	2.93	-2.33	-0.49	0.68	0.18
	Portland	-	1.50	-	-	-
	Charlottetown	-	-	-	0.56	-
	Port Rexton	-	-	-2.27	1.58	-0.61
	Hickmans Hr.	2.82	0.66	-	-	-
	Long Beach	-	-	-	-1.98	-
	Combined (1)	1.29	-0.87	-0.40	0.57	0.15
	(2)	0.76	-0.06	-0.76	0.67	-0.08
CB/ SS	Bay Roberts	-	-	-	-2.12	-

(1) communities consistent over five years
(2) all communities

Table 24. Calculation of instantaneous total mortality (Z) from research gillnet program, where F is number of days hauled.

Area	Community	Z3+ 1980-81	1981-82	1982-83	1983-84	1982-84
WB/ NDB	Croque	-	-	-	-	-
	Westport	0.26	-0.53	1.21	-0.69	0.03
	Brents Cove	-	-	-0.26	-0.52	-0.77
	La Scie	1.41	-	-	-	-
	Harry's Harbour	-	-	-	2.04	-
	Leading Tickles	-	-	-	0.07	-
	Hillgrade	1.83	-	-	-	-
	Herring Neck	-	-	-	-	-
	Combined (1)	0.26	-0.53	1.21	-0.69	0.03
	(2)	1.92	-0.50	-0.20	0.01	-0.24
BB/ TB	Centreville	-0.10	0.79	0.26	-0.21	0.10
	Salvage	2.93	-2.49	-0.30	0.49	0.17
	Portland	-	0.82	-	-	-
	Charlottetown	-	-	-	0.25	-
	Port Rexton	-	-	-2.34	1.71	-0.55
	Hickmans Hr.	3.11	0.62	-	-	-
	Long Beach	-	-	-	-1.98	-
	Combined (1)	1.38	-0.95	-0.24	0.41	0.16
	(2)	0.86	0.07	-0.90	0.59	-0.30
CB/ SS	Bay Roberts	-	-	-	-1.52	-

(1) communities consistent over five years
(2) all communities

Table 25. Exploitable (5+) biomass (E.B.) and catchability coefficient (q) estimates, using different F_t's.

		F_t = 0.005		F_t = 0.01		F_t = 0.025	
Area	Year	E.B. 5+	q	E.B. 5+	q	E.B. 5+	q
White Bay-Notre Dame Bay							
	1977	635045	.0000027	343711	.0000049	168913	.0000101
	1978	527349	.0000025	280193	.0000048	131901	.0000102
	1979	457017	.0000025	236109	.0000048	103561	.0000109
	1980	398743	.0000025	203332	.0000049	86108	.0000115
	1981	359200	.0000027	181047	.0000053	74156	.0000129
	1982	304956	.0000034	152829	.0000069	61567	.0000171
	1983	310519	.0000033	155495	.0000067	62481	.0000166
	1984	456115	.0000021	227885	.0000042	90957	.0000105
Bonavista Bay-Trinity Bay							
	1979	60869	.0000248	36342	.0000476	21612	.0000800
	1980	48475	.0000229	27098	.0000410	14270	.0000778
	1981	44823	.0000199	22778	.0000391	9549	.0000932
	1982	44094	.0000229	22123	.0000457	8941	.0001130
	1983	50434	.0000240	25258	.0000479	10152	.0001192
	1984	75113	.0000144	37501	.0000288	14971	.0000721

Table 26. Calculation of catch curves for White Bay-Notre Dame Bay (1977-84) and Bonavista Bay-Trinity Bay (1979-84) where 'C' is the commercial gillnet catch (numbers) of 1969 yearclass and older and 'f' is total gillnet effort only.

Area	Year							
	1977	1978	1979	1980	1981	1982	1983	1984
White Bay-Notre Dame Bay								
≤C	25278	18946	26142	9558	5874	3474	690	1321
Total G.N. catch	26604	23326	32369	12243	8515	5222	1118	3106
Catch rate	1.70	1.34	1.13	0.99	0.96	1.05	1.04	0.96
G.N. effort (f)	15649	17407	28645	12367	8870	4973	1075	3236
≤C/f	1.62	1.09	0.91	0.77	0.66	0.50	0.64	0.41
In ≤C/f	0.48	0.09	-0.09	-0.26	-0.42	-0.69	-0.45	-0.89
Bonavista Bay-Trinity Bay								
≤C	-	-	8806	4269	4627	1135	128	152
Total G.N. catch	-	-	9089	4638	5363	1342	178	595
Catch rate	-	-	1.73	1.11	0.89	1.01	1.21	1.08
G.N. effort (f)	-	-	5254	4178	6026	1329	147	551
≤C/f	-	-	1.68	1.02	0.77	0.85	0.87	0.28
In ≤C/f	-	-	0.52	0.02	-0.26	-0.16	-0.14	-1.27

Table 27. Calculation of herring biomass, Notre Dame Bay, Bonavista Bay, and Trinity Bay, from acoustic purse seine surveys conducted in 1983 and 1984.

	Notre Dame Bay		Bonavista Bay		Trinity Bay
	1983	1984	1983	1984	1984
m^2 schools observed	146556	197163	90850	203413	237608
# schools observed	252	595	210	850	512
m^2/school	582	331	433	239	464
tons/school	12.5	6.7	9.0	4.7	9.7
tons observed	3150	3987	1890	3995	4966
# km surveyed	968	738	631	946	802
km^2 surveyed	295	225	192	288	244
t/km^2	10.7	17.7	9.8	13.9	20.4
Biomass t (0-90 m)	50176	82432	18278	25308	26871

	White Bay-Notre Dame Bay		Bonavista Bay-Trinity Bay	
Stock biomass (t)	1983	1984	1983	1984
0-90 m	53538	87955	37685	52179

Table 28. Calculation of population numbers at age from weighted age compositions and biomass estimates as derived from acoustic purse seine surveys.

		1983		1984	
	Age	%	#'s ($x10^6$) (0-90 m)	%	#'s ($x10^6$) (#0-90 m)
White Bay-Notre Dame Bay					
	0	.280	333	-	-
	1	.531	632	.248	160
	2	.021	25	.574	371
	3	.003	4	.005	3
	4	.066	79	.004	3
	5	.006	7	.027	17
	6	.004	5	.006	4
	7	.017	12	.004	3
	8	-	-	.011	7
	9	.014	17	-	-
	10	-	-	.003	2
	11+	.059	70	.118	76
Total #'s ($x10^6$)			1190		647
Mean wgt. (kg)			.045		.136
Total biomass (t)			53538		87955
Bonavista Bay-Trinity Bay					
	0	.002	2	.046	22
	1	.991	934	.084	41
	2	.002	2	.700	338
	3	-	-	.007	3
	4	.001	1	.017	8
	5	-	-	.063	30
	6	-	-	.002	1
	7	-	-	.002	1
	8	-	-	.002	1
	9	-	-	.002	1
	10	-	-	.007	3
	11+	.004	4	.070	34
Total #'s ($x10^6$)			947		483
Mean wgt. (kg)			.040		.108
Total biomass (t)			37865		52179

Table 29. The relationship between the 1982 and 1968 yearclasses from cohort analyses initiated with empirical 1984 population estimates derived from the acoustic survey.

Area	F_t	1968 yearclass	1982 yearclass	1982/83
White Bay-Notre Dame Bay*	0.0500	643292	441336	0.69
Bonavista Bay-Trinity Bay*	0.0110	783111	401213	0.51
Conception Bay-Southern Shore**	0.0180	134559	61297	0.45
Fortune Bay*	0.0062	162548	53389	0.33

* from acoustic survey
** interpolated

Table 30. Results of cohort analysis for White Bay-Notre Dame Bay, assuming F_t = 0.050.
Herring - White Bay/Notre Dame Bay - Fishing mortalities.

	Year									
Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	.000	.001	.000	.000	.000	.000	.000	.000	.000	.001
3	.000	.000	.000	.000	.000	.001	.001	.009	.000	.006
4	.000	.006	.000	.001	.000	.001	.006	.005	.002	.018
5	.002	.004	.004	.000	.000	.001	.011	.009	.012	.008
6	.002	.003	.001	.007	.000	.001	.001	.028	.022	.026
7	.005	.000	.004	.000	.008	.008	.002	.007	.055	.035
8	.009	.003	.006	.012	.001	.101	.009	.014	.008	.067
9	.011	.000	.012	.000	.012	.023	.018	.011	.039	.012
10	.004	.001	.021	.003	.009	.047	.025	.027	.028	.026
11	.028	.005	.001	.004	.010	.084	.014	.024	.032	.045
12	.037	.038	.006	.001	.013	.095	.026	.014	.029	.051
13	.053	.047	.051	.001	.003	.118	.030	.025	.016	.045
14	.070	.068	.061	.009	.004	.028	.038	.029	.030	.025
15	.093	.093	.090	.080	.032	.037	.008	.037	.035	.047
16	.127	.127	.126	.122	.107	.331	.011	.008	.045	.055
17	.182	.181	.181	.180	.173	.149	.123	.011	.010	.072
18	.279	.279	.278	.278	.275	.262	.218	.133	.014	.016
19	.498	.498	.498	.498	.496	.488	.456	.354	.176	.021
20	.498	.498	.498	.498	.496	.488	.456	.354	.176	.072
F_{2+}	.001	.003	.002	.002	.001	.010	.005	.010	.018	.029
F_{5+}	.005	.003	.005	.004	.004	.033	.009	.013	.020	.030

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	.005	.010	.000	.000	.034	.016	.024	.000	.000
3	.011	.092	.014	.005	.011	.058	.016	.015	.005
4	.038	.045	.153	.242	.160	.012	.172	.003	.047
5	.025	.037	.181	.090	.044	.235	.021	.016	.050
6	.018	.024	.107	.681	.154	.039	.073	.006	.050
7	.063	.022	.087	.151	.032	.164	.026	.033	.049
8	.106	.059	.091	.593	.099	.161	.072	.001	.045
9	.103	.112	.114	.366	.088	.092	.065	.009	.038
10	.060	.115	.144	.215	.126	.130	.068	.018	.042
11	.058	.108	.136	.197	.117	.118	.064	.016	.038
12	.101	.103	.128	.186	.105	.108	.057	.015	.035
13	.117	.195	.121	.172	.098	.097	.052	.014	.033
14	.102	.231	.255	.162	.090	.089	.046	.012	.030
15	.055	.196	.318	.411	.084	.081	.043	.011	.027
16	.108	.098	.258	.567	.265	.075	.039	.010	.024
17	.127	.209	.115	.415	.431	.290	.036	.009	.021
18	.170	.254	.280	.152	.270	.591	.162	.008	.020
19	.036	.368	.361	.468	.079	.294	.445	.042	.018
20	.170	.368	.361	.681	.431	.591	.445	.042	.018
F_{2+}	.073	.092	.131	.218	.117	.095	.048	.010	.044
F_{5+}	.077	.094	.137	.234	.119	.119	.055	.013	.023

Table 30. Continued...
Herring - White Bay/Notre Dame Bay - Population numbers and biomass 2+ and 5+ estimates.

	Year									
Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	172911	180931	319087	69502	643292	530744	112388	20057	27197	4086
3	325699	141567	148056	261246	56902	526674	434536	92011	16420	22266
4	31845	266623	115866	121160	213841	46587	430930	355503	74673	13439
5	18696	26070	216889	94862	99104	175066	38096	350600	289710	61030
6	43321	15283	21267	176924	77649	81118	143188	30863	284398	234320
7	40430	35407	12474	17402	143808	63551	66362	117169	24567	227848
8	15155	32939	28988	10169	14247	116846	51641	54219	95266	19030
9	2287	12292	26890	23588	8228	11654	86496	41911	43791	77359
10	1765	1851	10063	21749	19304	6659	9329	69558	33935	34486
11	2994	1440	1515	8069	17753	15659	5200	7450	55416	27004
12	30	2384	1173	1239	6582	14384	11790	4197	5953	43927
13	22	24	1879	955	1014	5320	10708	9404	3389	4736
14	16	17	19	1463	781	827	3870	8509	7506	2730
15	12	12	13	14	1187	637	658	3051	6766	5963
16	9	9	9	10	11	941	502	535	2406	5350
17	7	7	7	7	7	8	553	407	434	1884
18	5	5	5	5	5	5	6	400	329	352
19	3	3	3	3	3	3	3	4	287	266
20	1	1	1	1	1	1	1	2	2	197
B_{2+}	95983	120525	149189	155976	203908	250144	267237	265305	240947	205441
B_{5+}	32431	33630	80682	91317	101894	128273	113836	180007	221578	199452

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	26181	5589	13936	5744	3793	31218	3539	3243	441336
3	3344	21325	4529	11409	4702	3002	25156	2829	2654
4	18114	2709	15918	3658	9293	3808	2320	20260	2281
5	10808	14278	2119	11186	2351	6487	3081	1599	16546
6	49551	8627	11266	1447	8372	1841	4197	2469	1288
7	186906	39831	6897	8285	599	5877	1451	3194	2009
8	180131	143724	31892	5178	5834	475	4083	1157	2531
9	14564	132660	110984	23836	2342	4328	331	3110	946
10	62580	10752	97124	81075	13538	1755	3232	254	2522
11	27502	48247	7849	68866	53518	9773	1262	2473	204
12	21139	21258	35440	5606	46281	38990	7113	969	1992
13	34168	15640	15695	25529	3813	34100	28652	5499	781
14	3707	24885	10539	11381	17594	2830	25350	22271	4440
15	2180	2741	16178	6683	7926	13163	2120	19815	18009
16	4656	1690	1845	9641	3627	5966	9937	1663	16045
17	4145	3423	1254	1167	4476	2277	4530	7828	1348
18	1436	2989	2274	916	631	2381	1396	3579	6350
19	283	992	1898	1408	644	394	1080	972	2906
20	213	224	562	1083	722	487	241	567	763
B_{2+}	172252	136461	105464	82355	58439	47751	36988	36240	54987
B_{5+}	166072	132633	100547	80104	55496	43777	32741	30040	27534

Table 31. Results of cohort analysis for Bonavista Bay-Trinity Bay, assuming F_t = 0.011. Herring - Bonavista Bay/Trinity Bay - Fishing mortalities.

Age	Year									
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
3	.000	.001	.000	.000	.000	.001	.000	.000	.000	.034
4	.004	.005	.000	.000	.000	.006	.003	.001	.000	.058
5	.001	.010	.005	.001	.000	.001	.013	.009	.002	.009
6	.008	.001	.003	.004	.007	.000	.003	.016	.016	.032
7	.013	.000	.003	.002	.013	.029	.002	.003	.023	.058
8	.016	.006	.015	.005	.020	.020	.017	.002	.008	.031
9	.022	.000	.040	.005	.017	.091	.012	.025	.010	.064
10	.028	.001	.017	.010	.016	.020	.013	.022	.020	.031
11	.158	.003	.002	.034	.008	.019	.013	.017	.021	.050
12	.034	.022	.007	.004	.030	.009	.013	.018	.017	.055
13	.051	.043	.046	.015	.003	.035	.006	.017	.017	.042
14	.070	.067	.056	.097	.013	.004	.023	.008	.016	.043
15	.093	.092	.088	.072	.089	.014	.002	.031	.008	.041
16	.127	.127	.125	.119	.096	.112	.010	.003	.030	.020
17	.181	.181	.181	.178	.167	.132	.079	.012	.003	.079
18	.279	.278	.278	.277	.272	.252	.189	.114	.011	.008
19	.498	.498	.498	.497	.494	.481	.430	.293	.120	.029
20	.498	.498	.498	.497	.494	.481	.430	.293	.120	.079
F_{2+}	.004	.003	.003	.003	.001	.003	.003	.008	.012	.048
F_{5+}	.014	.003	.007	.006	.009	.011	.008	.010	.013	.048

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	.003	.012	.004	.004	.006	.003	.000	.000	.000
3	.043	.064	.023	.069	.012	.136	.000	.001	.003
4	.054	.099	.123	.200	.061	.061	.008	.001	.006
5	.067	.111	.115	.419	.072	.107	.003	.006	.009
6	.011	.172	.047	.025	.281	.057	.016	.004	.011
7	.078	.004	.120	.110	.088	.490	.014	.010	.011
8	.112	.133	.061	.152	.090	.051	.099	.003	.010
9	.079	.176	.128	.071	.161	.152	.014	.029	.008
10	.071	.110	.142	.244	.180	.288	.041	.007	.009
11	.071	.107	.126	.222	.177	.241	.043	.006	.008
12	.120	.106	.122	.192	.158	.236	.034	.006	.008
13	.131	.192	.120	.184	.133	.206	.033	.005	.007
14	.098	.214	.240	.181	.127	.167	.028	.005	.007
15	.101	.152	.276	.436	.124	.159	.022	.004	.006
16	.096	.157	.183	.534	.386	.155	.022	.004	.005
17	.044	.150	.189	.306	.535	.719	.021	.004	.005
18	.197	.064	.179	.316	.240	1.465	.145	.003	.004
19	.021	.353	.071	.295	.245	.357	.523	.017	.004
20	.197	.353	.276	.534	.535	1.465	.523	.029	.004
F_{2+}	.094	.148	.131	.214	.157	.125	.015	.003	.001
F_{5+}	.097	.150	.135	.221	.167	.216	.031	.005	.006

Table 31. Continued...
Herring - Bonavista Bay/Trinity Bay - Population numbers and biomass 2+ and 5+ estimates.

	Year									
Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	20878	133803	73805	59070	783111	204516	37621	4000	15981	2462
3	162685	17093	109517	60426	48361	641156	167443	30801	3274	13084
4	4650	133165	13979	89627	49467	39594	524558	137082	25216	2680
5	19748	3794	108458	11444	73377	40491	32212	428246	112162	20643
6	11492	16160	3075	88374	9360	60067	33132	26020	347332	91617
7	8355	9334	13215	2511	72054	7612	49162	27044	20960	279985
8	12168	6754	7641	10791	2052	58208	6051	40182	22085	16762
9	1657	9800	5498	6161	8788	1647	46714	4873	32826	17944
10	1599	1328	8023	4327	5020	7073	1231	37806	3893	26603
11	2274	1273	1086	6457	3508	4043	5675	996	30269	3125
12	33	1590	1039	888	5109	2849	3247	4585	802	24257
13	22	26	1274	844	724	4060	2311	2625	3687	645
14	16	17	20	996	681	591	3211	1880	2113	2968
15	12	13	13	16	740	550	482	2569	1526	1702
16	9	9	9	10	12	555	444	394	2039	1240
17	7	7	7	7	7	9	406	360	321	1620
18	5	5	5	5	5	5	6	307	291	262
19	3	3	3	3	3	3	3	4	224	236
20	1	1	1	1	1	1	1	2	3	163
B_{2+}	40638	54042	62854	66988	127870	164695	184420	182371	160674	136147
B_{5+}	15239	13546	38752	35430	48310	50455	50434	149637	153768	133569

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	5432	1573	5828	1505	2625	47675	9064	9000	401213
3	2015	4435	1273	4751	1227	2136	38910	7420	7367
4	10354	1580	3406	1018	3631	992	1526	31849	6071
5	2071	8029	1172	2465	683	2797	765	1239	26045
6	16753	1585	5884	855	1328	520	2058	624	1008
7	72678	13565	1092	4598	683	821	402	1658	509
8	216227	55037	11061	793	3373	512	412	325	1344
9	13311	158200	39449	8524	558	2523	398	305	265
10	13785	10073	108657	28430	6499	389	1775	322	243
11	21121	10508	7386	77166	18241	4446	239	1394	262
12	2433	16114	7729	5332	50603	12510	2862	187	1134
13	18801	1767	11869	5603	3605	35374	8086	2265	153
14	507	13500	1194	8619	3816	2585	23576	6404	1845
15	2328	376	8927	769	5888	2752	1790	18763	5216
16	1337	1723	264	5546	407	4257	1922	1433	15293
17	995	995	1205	180	2663	226	2985	1540	1169
18	1226	779	701	817	109	1276	90	2394	1256
19	213	825	598	480	488	70	241	64	1954
20	188	171	474	456	293	313	40	117	52
B_{2+}	110744	85943	63401	50440	35184	29914	24709	27825	41700
B_{5+}	107905	84872	62058	49488	34047	25741	17196	16767	18306

Table 32. Results of cohort analysis for Conception Bay-Southern Shore, assuming $F_t = 0.018$.
Herring - Conception Bay/Southern Shore - Fishing mortalities.

	Year									
Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	.000	.000	.000	.000	.000	.000	.001	.060	.002	.023
3	.001	.001	.000	.001	.000	.000	.000	.001	.001	.347
4	.003	.002	.001	.000	.002	.008	.020	.001	.004	.042
5	.001	.003	.001	.002	.003	.002	.045	.072	.010	.017
6	.033	.004	.001	.003	.023	.001	.009	.117	.212	.208
7	.028	.002	.002	.002	.019	.051	.006	.094	.090	.310
8	.139	.007	.010	.003	.018	.025	.130	.036	.019	.093
9	.124	.001	.015	.003	.051	.055	.037	.090	.013	.172
10	.006	.006	.009	.005	.048	.057	.150	.025	.038	.111
11	.703	.008	.007	.007	.047	.052	.130	.024	.100	.064
12	.041	.040	.010	.009	.056	.052	.117	.023	.097	.185
13	.054	.053	.013	.012	.078	.061	.121	.018	.091	.179
14	.071	.070	.069	.016	.110	.089	.141	.023	.069	.168
15	.093	.094	.093	.091	.145	.129	.210	.026	.088	.123
16	.127	.127	.128	.127	.124	.178	.330	.029	.101	.162
17	.182	.182	.182	.182	.180	.175	.506	.049	.114	.190
18	.279	.279	.279	.279	.279	.276	.267	.084	.203	.219
19	.498	.498	.498	.498	.499	.500	.491	.468	.387	.457
20	.703	.498	.498	.498	.499	.500	.506	.468	.387	.457
F_2^+	.009	.002	.001	.002	.003	.003	.019	.056	.137	.247
F_5^+	.093	.006	.002	.004	.017	.017	.033	.068	.144	.250

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	.807	.020	.002	.006	.002	.000	.000	.001	.000
3	.033	.212	.004	.010	.007	.047	.000	.000	.005
4	.107	.014	.244	.040	.010	.037	.012	.000	.010
5	.039	.179	.116	.123	.006	.107	.012	.003	.015
6	.038	.104	.168	.033	.094	.064	.011	.014	.018
7	.394	.022	.043	.140	.006	.195	.009	.007	.018
8	.276	.270	.006	.015	.060	.022	.048	.011	.016
9	.078	.424	.347	.083	.005	.092	.009	.012	.014
10	.111	.069	.629	.207	.183	.078	.008	.011	.015
11	.092	.162	.123	.505	.176	.111	.031	.010	.014
12	.049	.132	.338	.061	.617	.108	.049	.010	.013
13	.166	.063	.261	.202	.046	.611	.048	.009	.012
14	.157	.261	.109	.144	.170	.025	.431	.005	.011
15	.139	.245	.669	.056	.114	.103	.010	.048	.010
16	.106	.202	.603	.565	.043	.066	.047	.006	.009
17	.134	.146	.432	.448	.759	.018	.030	.006	.008
18	.174	.193	.313	.249	.535	.943	.022	.005	.007
19	.162	.265	.406	.214	.261	.565	1.046	.028	.006
20	.807	.424	.669	.565	.759	.943	1.046	.048	.006
F_2^+	.264	.293	.405	.258	.207	.063	.017	.022	.001
F_5^+	.250	.305	.436	.284	.256	.183	.076	.010	.008

Table 32. Continued...
Herring - Conception Bay/Southern Shore - Population numbers and biomass 2+ and 5+ estimates.

	Year									
Age	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	2563	14147	15876	6212	134559	27194	1909	1291	1954	633
3	37818	2097	11579	12997	5085	110167	22264	1562	996	1597
4	1915	30942	1715	9478	10629	4162	90188	18222	1278	814
5	746	1564	25273	1404	7758	8687	3380	72369	14898	1042
6	656	610	1277	20676	1147	6333	7101	2645	55157	12080
7	789	520	498	1044	16869	918	5178	5764	1927	36523
8	1062	628	425	407	853	13549	714	4213	4295	1442
9	265	756	510	344	332	686	10814	513	3326	3448
10	172	192	618	412	281	258	532	8529	384	2687
11	276	140	156	502	335	219	200	375	6813	303
12	27	112	114	127	408	262	170	144	300	5050
13	21	21	88	92	103	316	203	124	115	223
14	16	16	17	71	74	78	243	148	100	86
15	12	12	12	13	57	55	58	173	118	76
16	9	9	9	9	9	41	39	39	138	89
17	7	7	7	7	7	7	28	23	31	102
18	5	5	5	5	5	5	5	14	18	22
19	3	3	3	3	3	3	3	3	10	12
20	1	1	1	1	1	1	1	1	2	6
$B_{2}+$	8284	10124	11449	11987	22238	30871	33637	30796	25529	19319
$B_{5}+$	1198	1333	7806	7044	8101	8985	8415	26127	24902	18804

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	2088	384	528	183	733	6590	4281	752	61297
3	507	763	308	431	149	599	5395	3504	615
4	924	401	505	251	349	121	468	4415	2868
5	640	680	324	324	198	283	96	379	3614
6	838	504	465	236	235	161	208	77	309
7	8030	661	372	322	187	175	124	169	62
8	21925	4436	529	292	229	152	118	100	137
9	1075	13627	2772	431	235	177	122	92	81
10	2378	814	7302	1605	325	192	132	99	74
11	1968	1742	622	3188	1068	221	145	107	80
12	232	1470	1213	451	1575	733	162	115	87
13	3435	181	1055	708	347	696	539	127	93
14	152	2382	139	665	474	272	309	420	103
15	59	107	1502	102	472	327	217	164	342
16	55	42	68	630	79	344	242	176	128
17	62	41	28	31	293	62	264	189	143
18	69	44	29	15	16	112	50	210	154
19	15	48	30	17	10	8	36	40	171
20	6	10	30	16	11	6	4	10	32
$B_{2}+$	13031	8727	5664	3374	2277	2152	2209	3011	7129
$B_{5}+$	12560	8472	5450	3240	2102	1420	1005	956	1923

Table 33. Two partial recruitment options used for stock projections, one based upon a combined purse seine and gillnet fishery and the second for a gillnet fishery only.

Option		Age									
		2	3	4	5	6	7	8	9	10	11+
1	White Bay-Notre Dame Bay	0.10	0.35	0.55	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Bonavista Bay-Trinity Bay	0.15	0.33	0.55	0.83	1.00	1.00	1.00	1.00	1.00	1.00
	Conception Bay-Southern Shore	0.15	0.45	0.60	0.80	1.00	1.00	1.00	1.00	1.00	1.00
2	All areas	0.01	0.12	0.42	0.90	1.00	0.99	0.90	0.76	0.83	0.53

Table 34. 1986 catch projection for White Bay-Notre Dame Bay using the population vector derived from the acoustic survey, a projected catch of 2000 t in 1985 and two options of partial recruitment patterns.

Option #1 - Combined purse seine and gillnet fishery

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	10000	600	.030	268	16	7945	477
3	123197	18480	.105	11149	1672	90811	13622
4	282429	71172	.165	39043	9839	196061	49407
5	2441	588	.300	576	139	1481	357
6	1920	658	.300	453	155	1164	399
7	12958	3952	.300	3059	933	7860	2397
8	2879	1028	.300	680	243	1746	624
9	1920	705	.300	453	166	1164	427
10	5286	2104	.300	1248	497	3206	1276
11+	58085	22244	.300	13711	5251	35226	13491
Total	501115	121533		70642	18912	346669	82479

Option #2 - Gillnet fishery only

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	10000	600	.003	27	2	8163	490
3	123593	18539	.036	3963	594	97611	14642
4	284134	71602	.126	30551	7699	205089	51683
5	2430	586	.270	523	126	1519	366
6	1887	647	.300	446	153	1145	393
7	12663	3862	.297	2964	904	7703	2350
8	2816	1005	.270	607	217	1760	628
9	1887	693	.228	350	128	1230	451
10	5242	2086	.249	1052	419	3346	1332
11+	57772	22124	.159	9451	3619	38791	14854
Total	502422	121746		49934	13862	366354	87189

Table 35. 1986 catch projection for Bonavista Bay-Trinity Bay using the population vector derived from the acoustic survey, a projected catch of 800 t in 1985 and two options of partial recruitment patterns.

Option #1 - Combined purse seine and gillnet fishery

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	5000	265	.045	200	11	3914	207
3	31186	4054	.099	2669	347	23126	3006
4	258816	49951	.165	35779	6905	179669	34676
5	2575	621	.249	517	124	1644	396
6	6214	1796	.300	1467	424	3769	1089
7	22940	7226	.300	5416	1706	13914	4383
8	728	239	.300	172	56	442	145
9	728	243	.300	172	57	442	147
10	728	249	.300	172	59	442	151
11+	29164	11283	.300	6884	2664	17691	6844
Total	358079	75930		53445	12353	245050	51047

Option #2 - Gillnet fishery only

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	5000	265	.003	14	1	4081	216
3	31282	4067	.036	1003	130	24706	3212
4	259700	50122	.126	27924	5389	187453	36178
5	2570	619	.270	554	133	1607	387
6	6141	1775	.300	1450	419	3725	1076
7	22679	7144	.297	5308	1672	13797	4346
8	720	236	.270	155	51	450	148
9	722	241	.228	134	45	471	157
10	726	248	.249	146	50	463	158
11+	29110	11263	.159	4809	1862	19504	7545
Total	358650	75982		41496	9752	256254	53426

Table 36. 1986 catch projection for Conception Bay-Southern Shore using the population vector derived from the acoustic survey, a projected catch of 200 t in 1985 and two options of partial recruitment patterns.

Option #1 - Combined purse seine and gillnet fishery

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	500	36	.045	20	1	391	28
3	407	74	.135	47	8	291	53
4	40455	10478	.180	6058	1569	27666	7165
5	401	117	.240	78	23	258	75
6	1851	663	.300	437	156	1123	402
7	2306	802	.300	544	189	1398	487
8	197	72	.300	46	17	119	43
9	40	15	.300	9	4	24	9
10	88	37	.300	21	9	53	23
11+	953	445	.300	224	105	580	271
Total	47199	12740		7486	2082	31904	8556

Option #2 - Gillnet fishery only

Age	Population numbers ($x10^3$)	Population weight (t)	Fishing mortality	Catch numbers ($x10^3$)	Catch weight (t)	Residual numbers ($x10^3$)	Residual weight (t)
2	500	36	.003	1	0	408	29
3	409	74	.036	13	2	323	58
4	40744	10553	.126	4381	1135	29409	7617
5	397	116	.270	86	25	248	73
6	1786	640	.300	422	151	1084	388
7	2225	774	.297	521	181	1354	471
8	190	69	.270	41	15	119	43
9	38	15	.228	7	3	25	10
10	86	37	.249	17	7	55	23
11+	955	447	.159	113	53	679	316
Total	47331	12759		5602	1572	33704	9030

Table 37. Illustrative projections, 1985-90, for White Bay-Notre Dame Bay using the population vector derived from the acoustic survey, a projected catch of 2000 t in 1985, partial recruitment for a combined purse seine and gillnet fishery, geometric mean recruitment, and two options of F.

F	Year	2+ Biomass	5+ Biomass	Catch (t)
0.30	1985	101171	38900	2000
	1986	123014	31279	18954
	1987	96118	66744	19369
	1988	79712	67876	17212
	1989	57826	45990	12045
	1990	45569	33733	9152
0.20	1985	101171	38900	2000
	1986	123104	31279	13060
	1987	101698	71465	14328
	1988	90905	78780	13821
	1989	70186	58061	10406
	1990	58124	45999	8418
Max. levels	1972	267237	-	
	1974	-	221578	
Min. levels	1983	36240	-	
	1984	-	27534	

Table 38. Illustrative projections, 1985-90, for Bonavista Bay-Trinity Bay using the population vector derived from the acoustic survey, a projected catch of 800 t in 1985, partial recruitment for a combined purse seine and gillnet fishery, geometric mean recruitment, and two options of F.

F	Year	2+ Biomass	5+ Biomass	Catch (t)
0.30	1985	69122	25075	800
	1986	76703	21660	12385
	1987	64336	56841	12712
	1988	50562	45335	11081
	1989	37118	31891	7977
	1990	27633	22406	5738
0.20	1985	69122	25075	800
	1986	76703	21660	8542
	1987	68379	60704	9406
	1988	57797	52432	8897
	1989	45688	40323	6955
	1990	36046	30671	5366
Max. levels	1972	184420	-	
	1974	-	153768	
Min. levels	1982	24709	-	
	1983	-	16767	

Table 39. Illustrative projections, 1985-90, for Conception Bay-Southern Shore using the population vector derived from cohort analysis with F_t = 0.018, a projected catch of 200 t in 1985, partial recruitment for a combined purse seine and gillnet fishery, geometric mean recruitment and two options of F.

F	Year	2+ Biomass	5+ Biomass	Catch (t)
0.30	1985	11868	2431	200
	1986	13319	2152	2135
	1987	10569	9424	2017
	1988	8722	7595	1906
	1989	6077	4950	1282
	1990	4669	3542	950
0.20	1985	11868	2431	200
	1986	13319	2152	1470
	1987	11236	10062	1490
	1988	9943	8781	1526
	1989	7427	6265	1112
	1990	6007	4845	878
Max. levels	1972	33637	-	
	1973	-	26127	
Min. levels	1981	2152	-	
	1983	-	956	

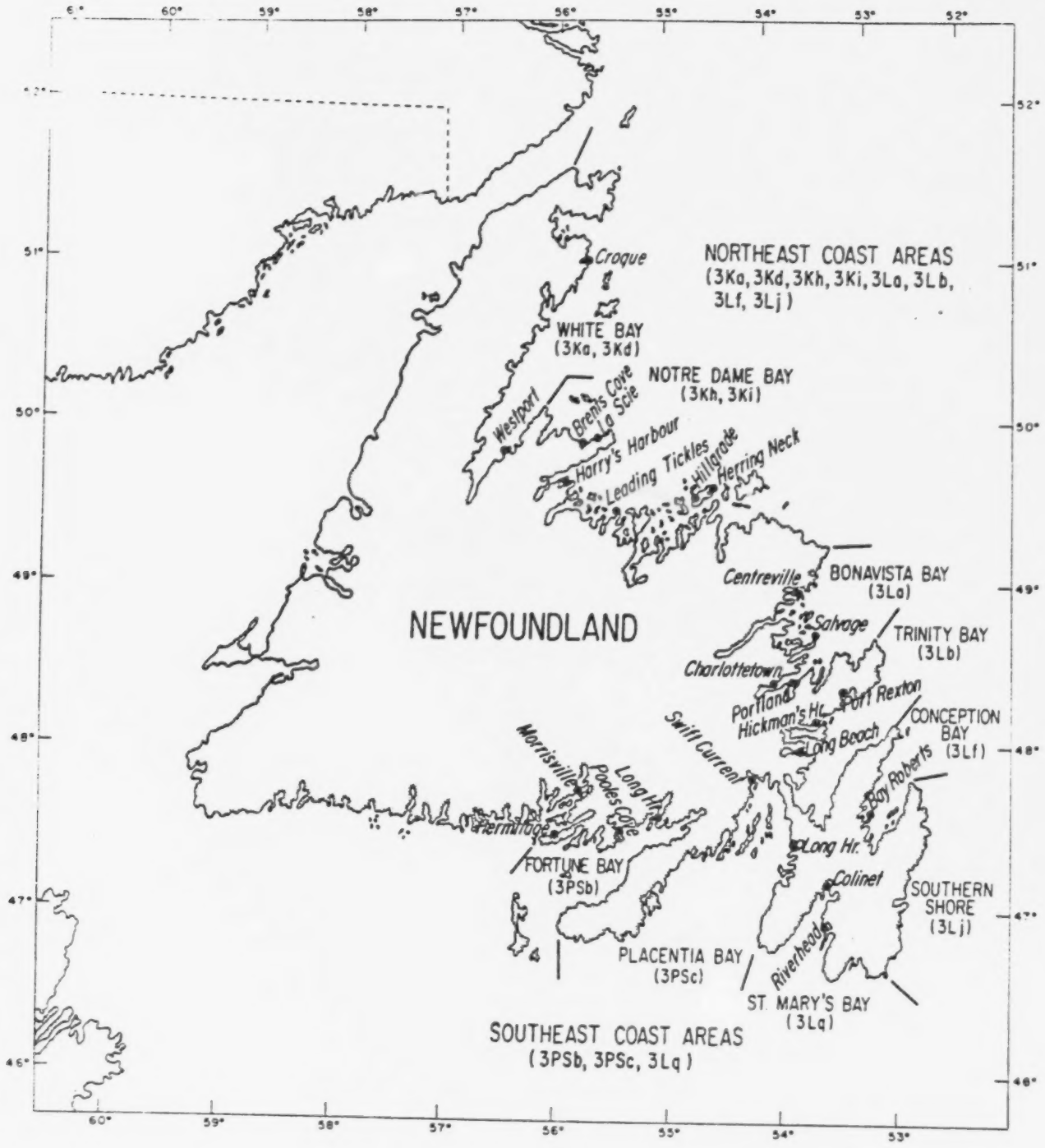

Fig. 1. Area map of Newfoundland indicating stock complexes and research gillnet community locations.

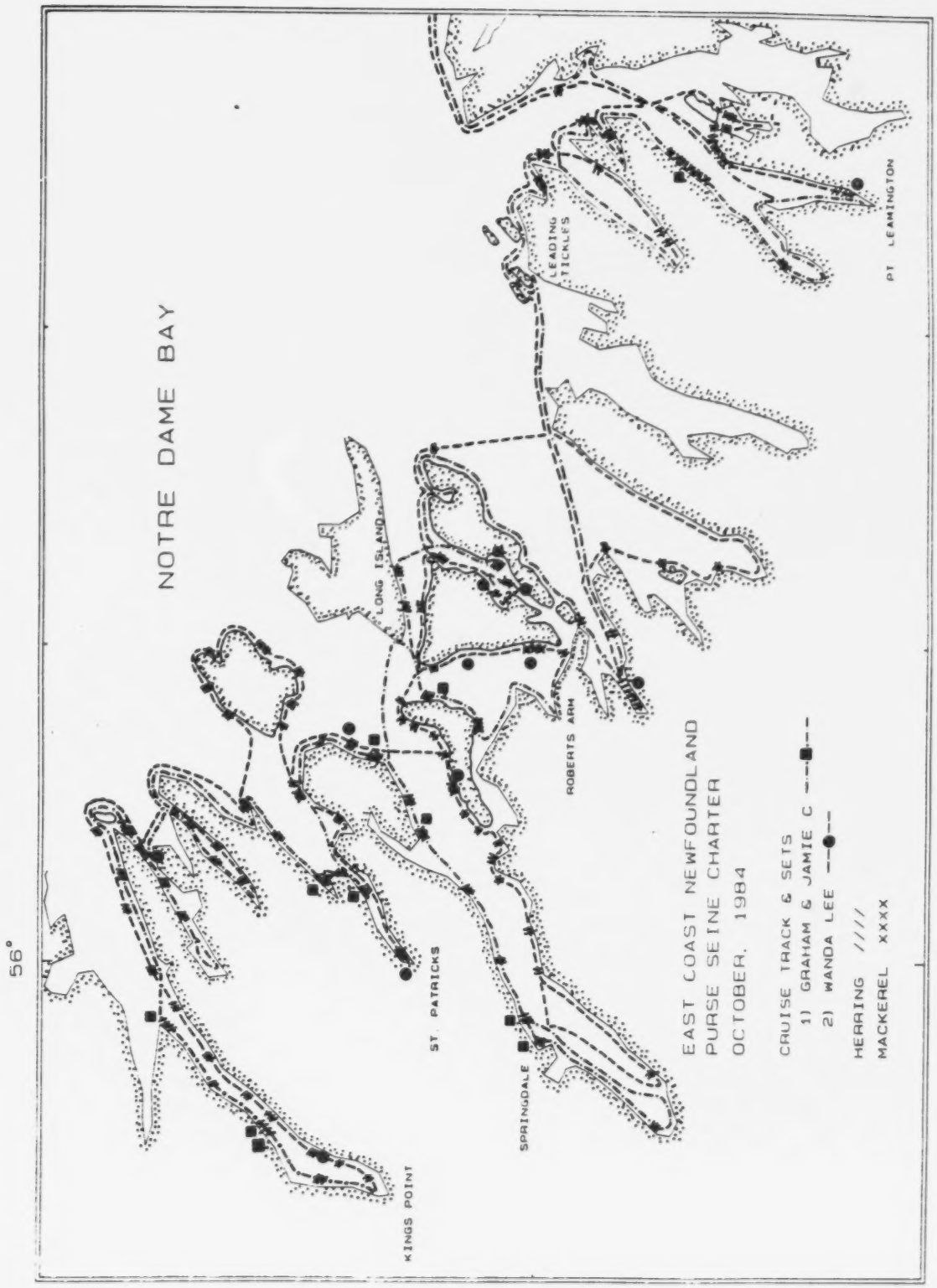

Fig. 2 . Cruise track, herring markings, and set locations, research purse seine survey, Notre Dame Bay, 1984.

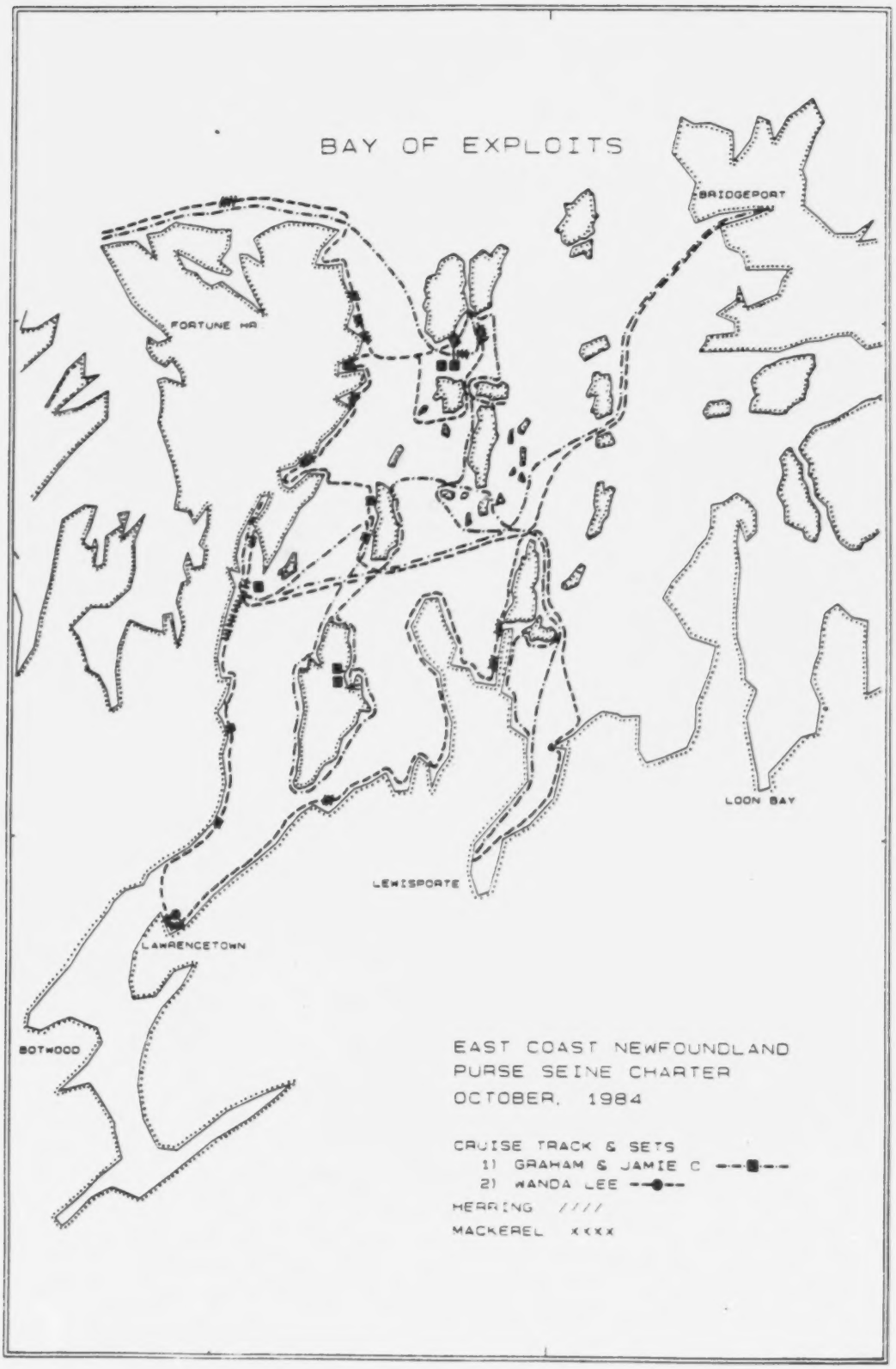

Fig. 3 . Cruise track, herring markings, and set locations, research purse seine survey, Notre Dame Bay (Bay of Exploits) 1984.

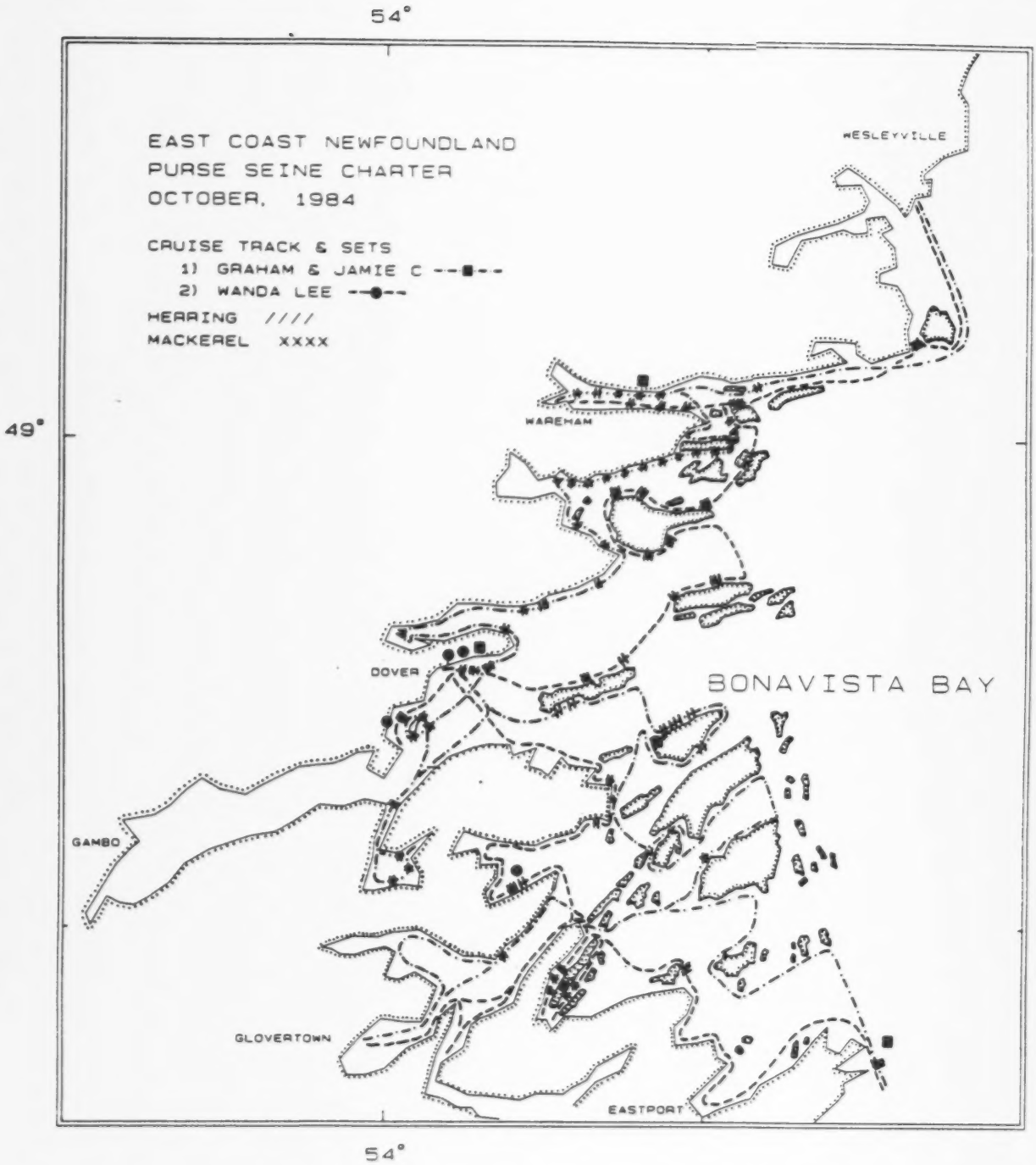

Fig. 4. Cruise track, herring markings, and set locations, research purse seine survey, Bonavista Bay, 1984.

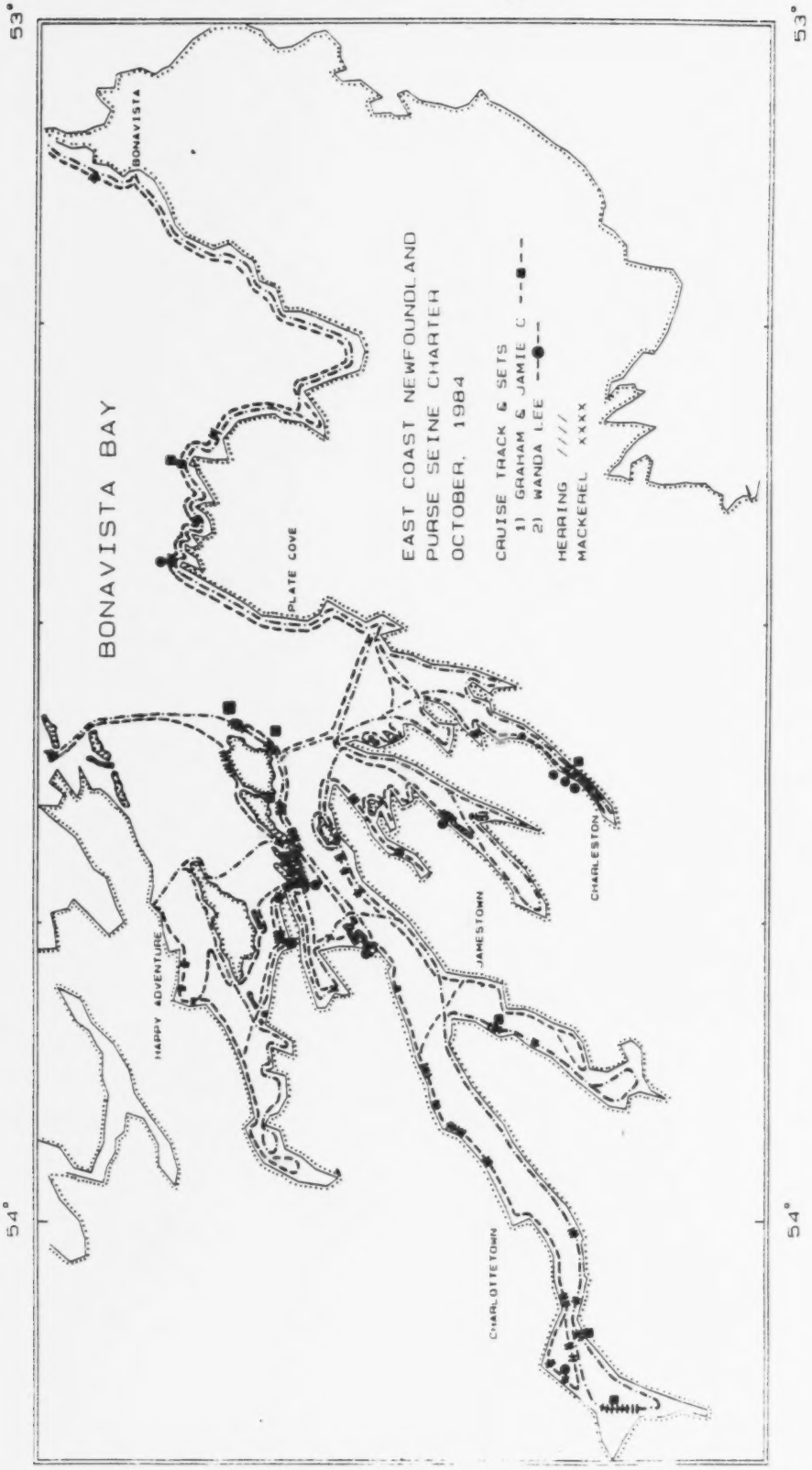

Fig. 5. Cruise track, herring markings, and set locations, research purse seine survey, Bonavista Bay, 1984.

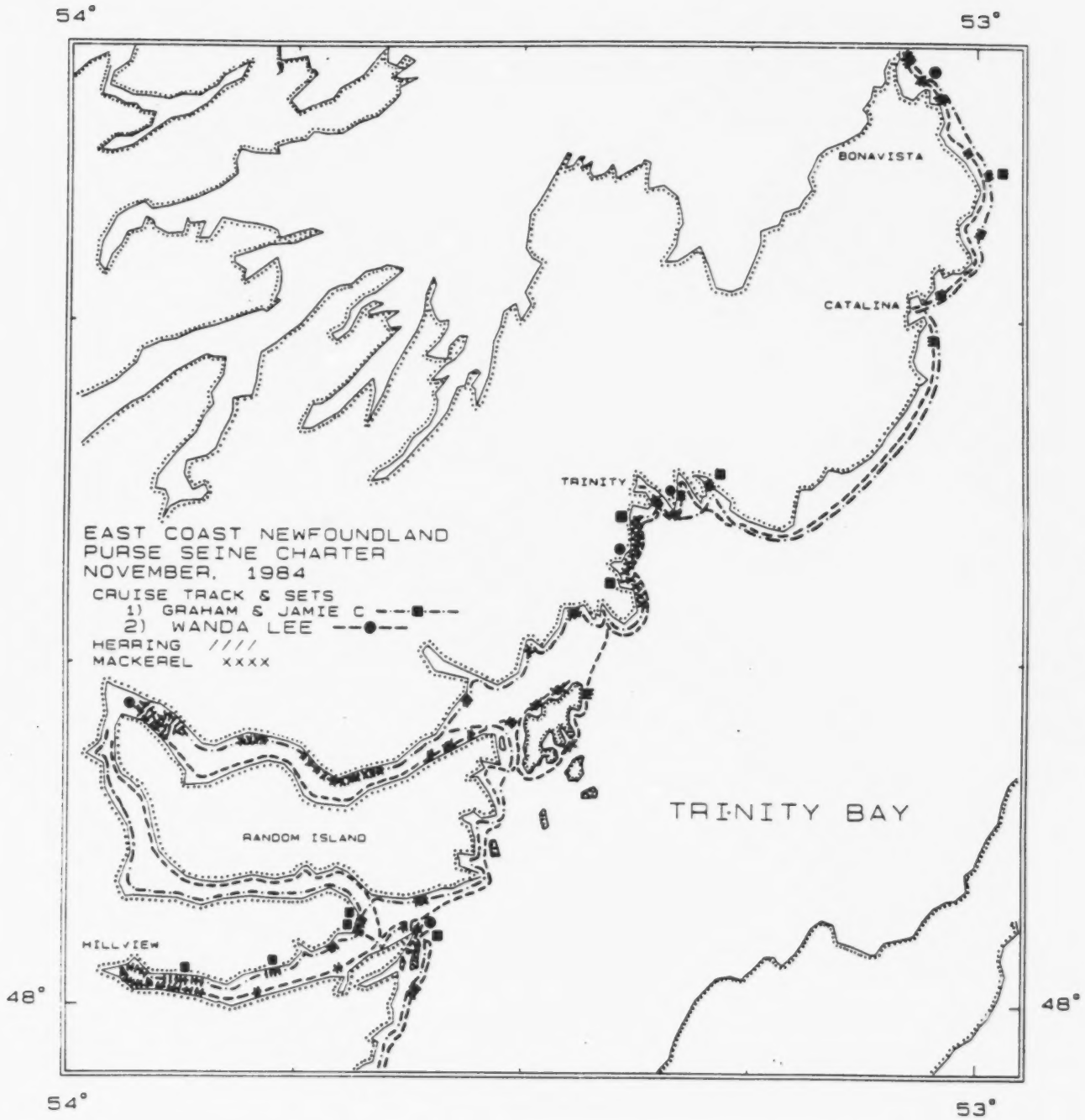

Fig. 6 . Cruise track, herring markings, and set locations, research purse seine survey, Trinity Bay, 1984.

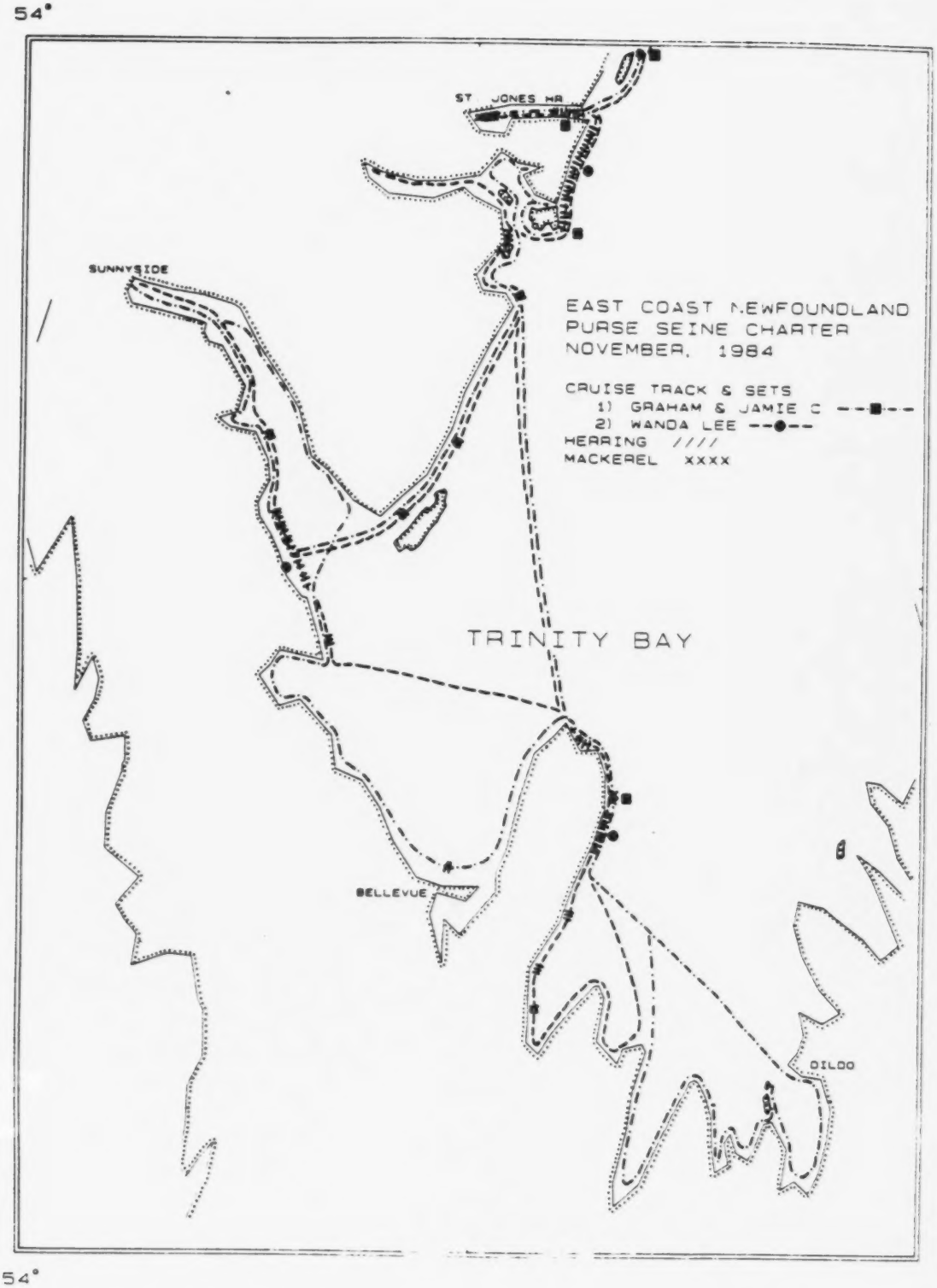

Fig. 7. Cruise track, herring markings, and set locations, research purse seine survey, Trinity Bay, 1984.

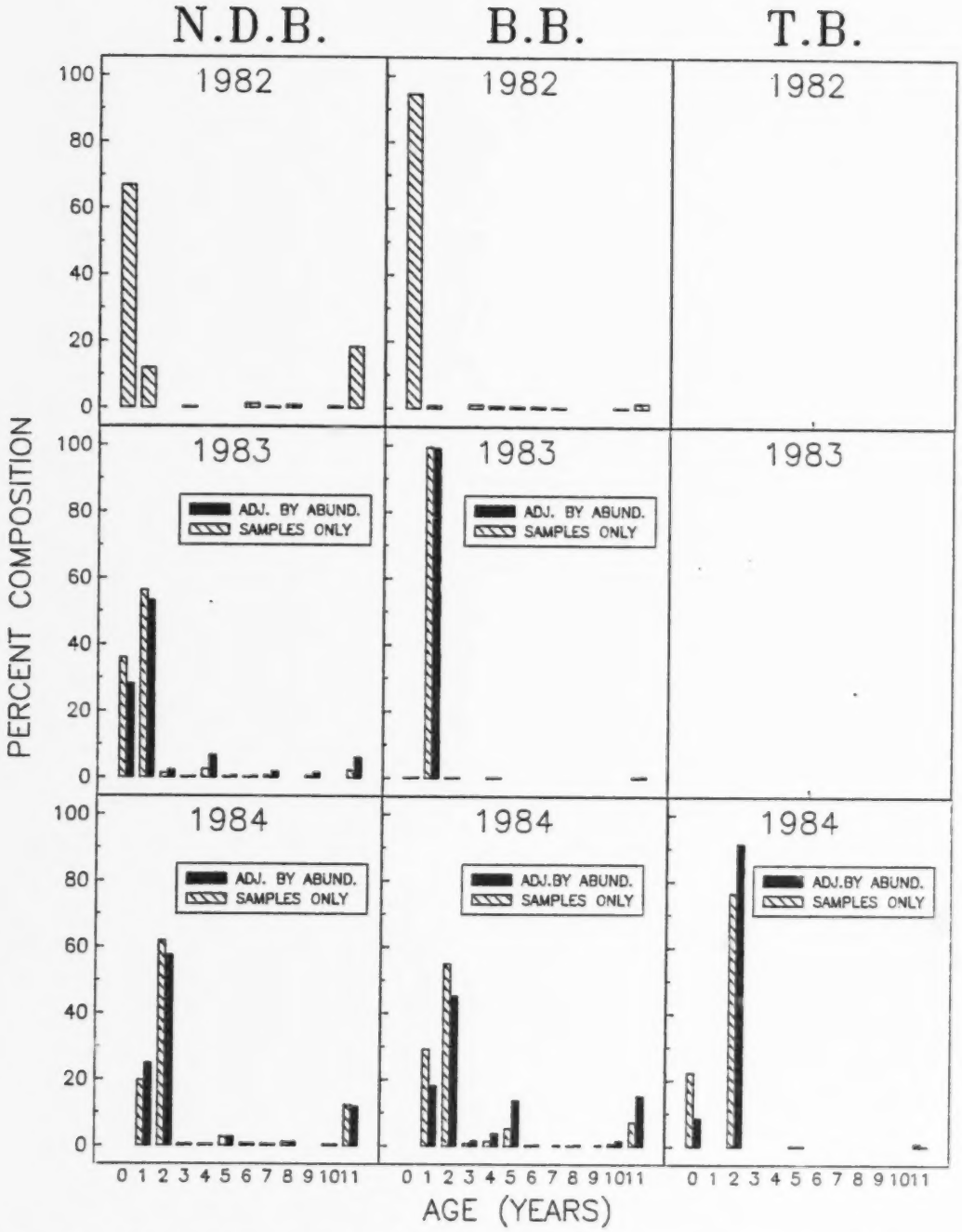

Fig. 8 Age composition of herring from acoustic purse seine survey samples, Notre Dame Bay, Bonavista Bay, and Trinity Bay, 1982–84.

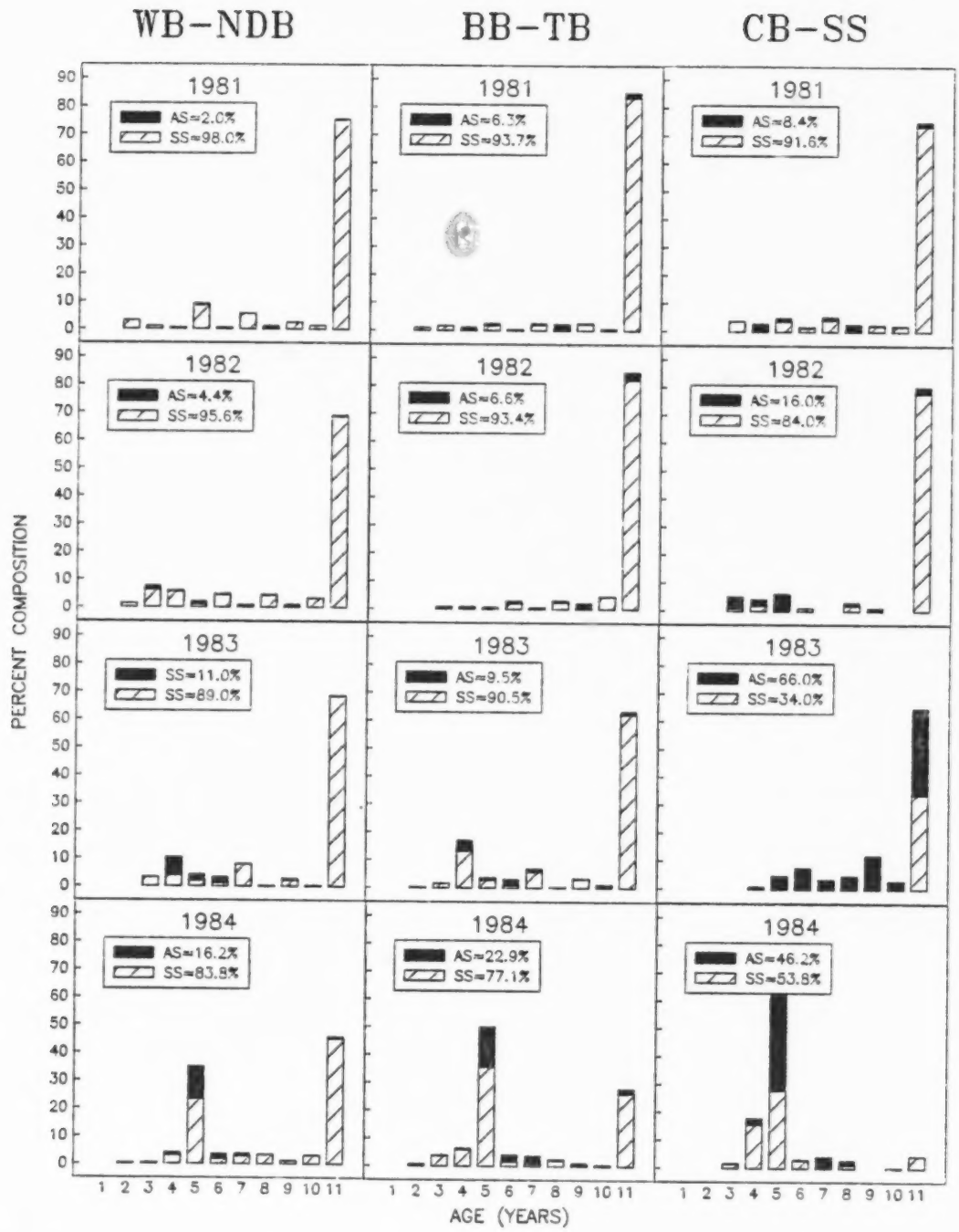

Fig. 9 Age composition of herring from commercial fishery, White Bay – Notre Dame Bay, Bonavista Bay – Trinity Bay, and Conception Bay – Southern Shore, 1981–84.

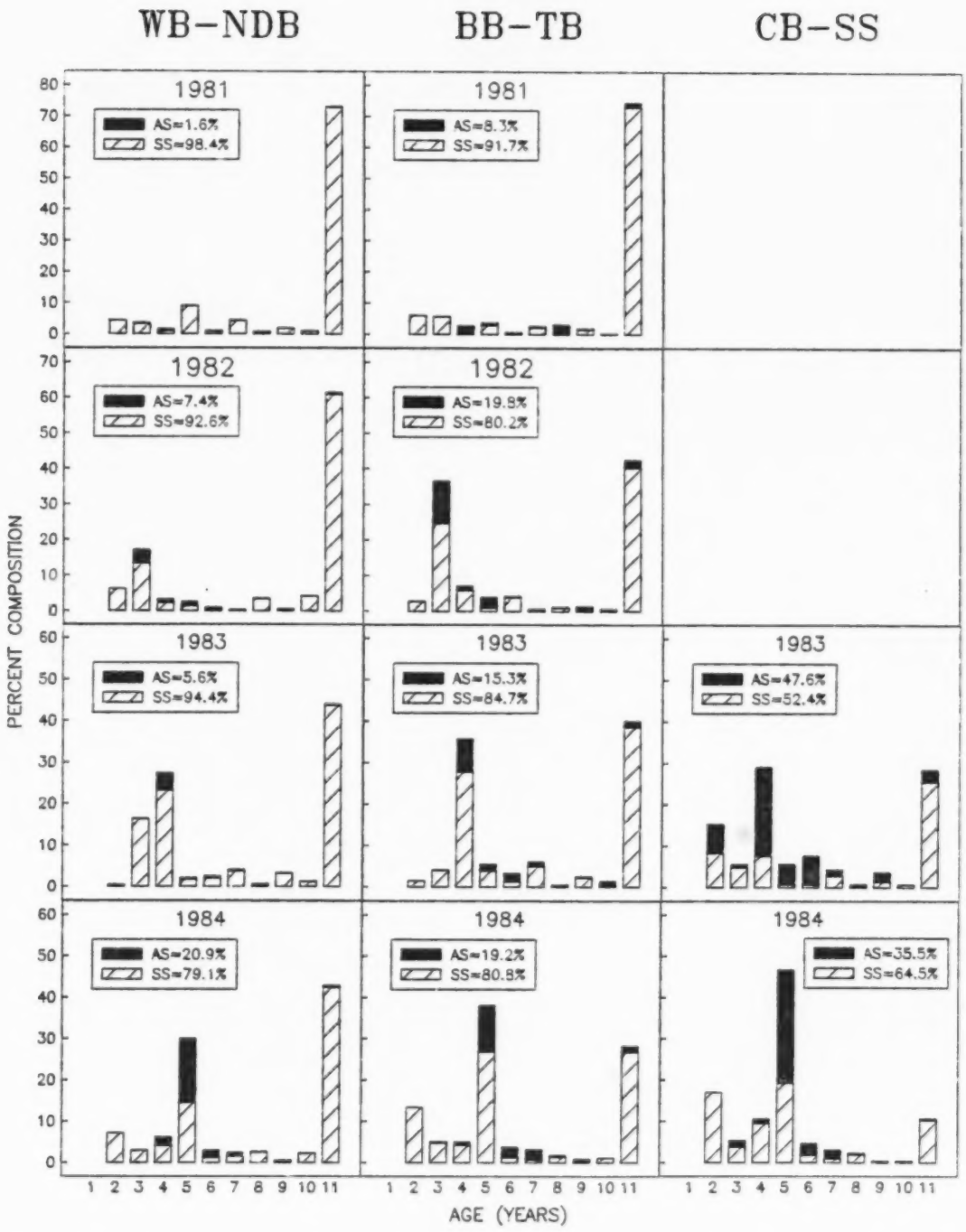

Fig. 10 Age composition of herring from research gillnets, White Bay – Notre Dame Bay, Bonavista Bay – Trinity Bay, and Conception Bay – Southern Shore, 1981–84.

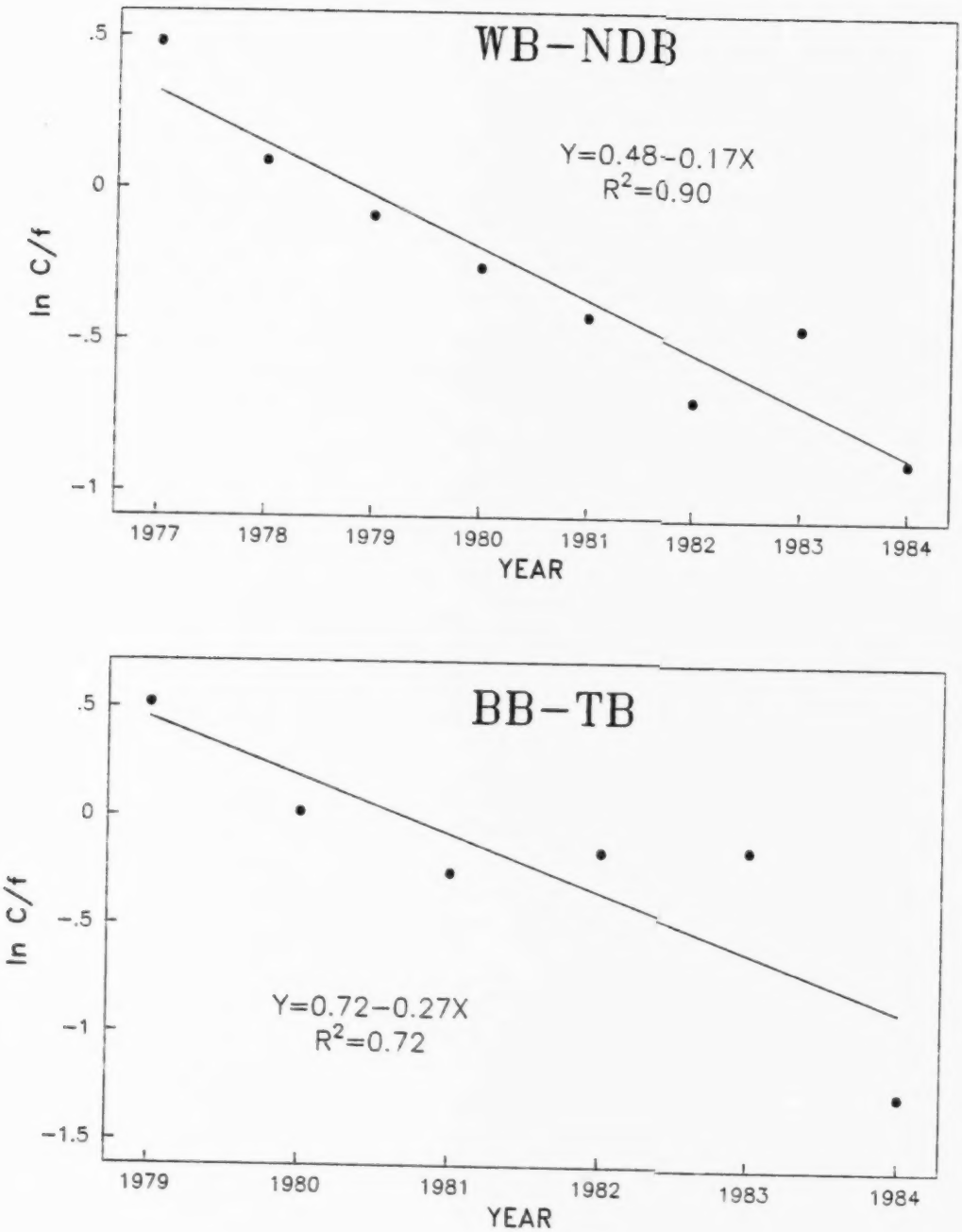

Fig. 11 Catch curves for White Bay – Notre Dame Bay and Bonavista Bay – Trinity Bay where 'C' is commercial gillnet catches of 1969 yearclass and older and 'f' is total gillnet effort only.

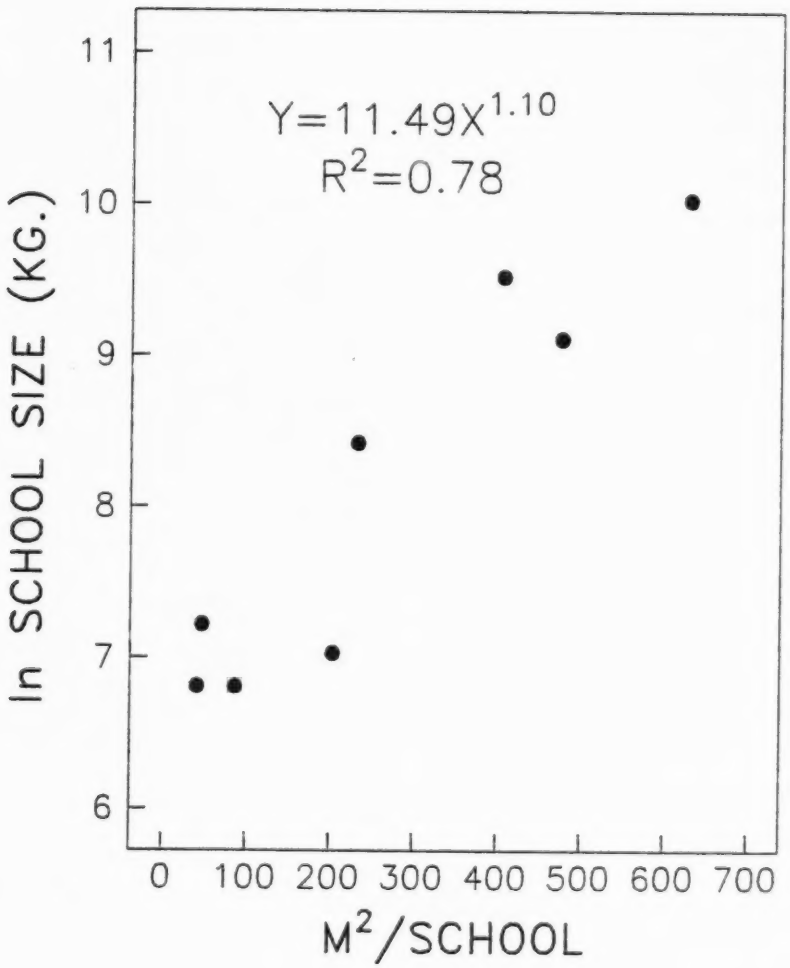

Fig. 12 The relationship between school dimensions (m^2),and school size (kg.) as estimated from the acoustic purse seine survey, 1984.

Appendix 1. Purse seine sets - "Graham & Jamie C." and "Wanda Lee", October-November 1984.

Vessel set no.		Date	Time	Locality	Surface temp. °C	Catch no. lbs.	Average size (mm)		Sample no.	Comments
GJC	WL						Her.	Mack.		
-	1	Oct. 11	1638	Green Bay, Manful Pt.	8.5	-	-	-	-	water too deep, fish wild, no catch
1	-	Oct. 2	1645	Green Bay, Rattling Brook	8.6	-	-	-	-	fish wild, no catch
2	-	Oct. 2	1910	Green Bay, Rattling Brook	8.6	40,000	354	-	H1	all mature age 11+, same school as set #1
3	-	Oct. 3	1045	Green Bay, Middle Arm Pt.	8.8	5,000	244	-	H2	all juvenile, '82 yc, tagged 1000
-	2	Oct. 3	1410	Western Arm, Rushy Pond Cove	9.0	-	-	-	-	set upon breech of mackerel, no catch
4	-	Oct. 4	0920	Little Bay, Long Beach	9.3	-	-	(1) 240	-	caught one mackerel only
-	3	Oct. 4	1140	St. Patricks	9.0	(58)	168	-	H3	all juvenile, '83 yc
5	-	Oct. 4	1145	Little Bay, off ferry wharf	9.3	2,000	215	-	H4	mixed school, '82 & '83 yc plus some mature
-	4	Oct. 4	1443	Halls Bay, Indian Beach	9.5	-	-	-	-	caught one juvenile haddock only
6	-	Oct. 4	1505	Halls Bay, Indian Head	8.9	2,000	243	-	H5	mixed school, mostly '82 yc, some '83 yc
-	5	Oct. 4	1618	Halls Bay, Hunts Rock	9.6	-	-	(8) 370	-	set upon breech of mackerel, tore seine
7	-	Oct. 4	1640	Halls Bay, Saltwater Pond Pt.	8.8	-	-	-	-	set upon breech of mackerel, no catch
8	-	Oct. 6	0955	Halls Bay, Springdale wharf	4.9	-	-	-	-	set went well, no catch
9	-	Oct. 6	1303	Halls Bay, outside Springdale	6.2	-	-	-	-	seine fouled, no catch
10	-	Oct. 6	1905	Roberts Arm, Paddock Bight	8.3	(27)	239	-	H6	all juvenile, '82 yc
-	6	Oct. 6	1928	Sunday Cove Is., off Miles Cove	8.3	(38)	239	(3) 380	H7	all juvenile, '82 yc, plus 3 mackerel
-	7	Oct. 7	0900	Roberts Arm	8.6	40,000	-	385	M1	all mackerel, tagged 4000
11	-	Oct. 7	1443	Pelleys Tickle	8.9	-	-	-	-	set went well, no catch
-	8	Oct. 7	1510	Pelleys Tickle, Dogfish Rock	9.0	-	-	-	-	set went well, no catch
-	9	Oct. 7	1645	Pelleys Tickle, Big Island	9.3	1,000	-	332	M2	all mackerel
-	10	Oct. 8	1230	Badger Bay, Sops Arm	8.0	30,000	223	-	H8	mixed school, '82 & '83 yc, tagged 1000 '82s
12	-	Oct. 9	0945	New Bay, opp. Strong Is.	9.4	-	-	(8) 370	-	set upon breech of mackerel
-	11	Oct. 9	1155	New Bay, Point Leamington	9.4	10,000	229	-	H9	mixed school, '82 & '83 yc, tagged 1000 '82s
13	-	Oct. 9	1815	Exploits Bay, off Exploits Hr.	9.2	(1)	230	-	-	seine fouled, caught one '82 yc
14	-	Oct. 9	1850	Exploits Bay, off Exploits Hr.	9.2	-	-	-	-	set went well, too windy, no catch
15	-	Oct. 11	1130	Exploits Bay, St. John Hr.	9.2	(100)	232	-	H10	all juvenile, '82 yc
16	-	Oct. 11	1235	Exploits Bay, St. John Hr.	9.2	-	-	-	-	tore seine, no catch
-	12	Oct. 11	1440	Exploits Bay, Laurenceton	8.4	20,000	222	-	H11	all juvenile, '82 yc, tagged 1000
17	-	Oct. 11	2005	Exploits Bay, Sunday Is.	9.4	1,000	356	-	H12	all mature, 60% age 11+, 20% '79 yc
18	-	Oct. 16	1705	Indian Bay, Gull Island	7.8	3,000	240	-	H13	all juvenile, '82 yc, tagged 1000
-	13	Oct. 17	1327	Shoal Bay, off Dover	7.9	-	-	-	-	set went well, no catch
-	14	Oct. 17	1457	Shoal Bay, off Dover	7.9	-	-	-	-	water too deep, no catch
-	15	Oct. 17	1610	Hare Bay, Hare Is.	7.5	3,000	231	-	H14	mixed school, '82 & '83 yc, tagged 1000 '82s
19	-	Oct. 17	1725	Shoal Bay, Pincher Is.	7.9	3,000	237	-	H15	all juvenile, '82 yc
-	16	Oct. 18	1048	Rocky Bay, Band Is.	7.8	50,000	336	-	H16	mostly mature, few '82 yc mixed
20	-	Oct. 18	1130	Pitt Sound Island, west side	9.0	1,000	245	-	H17	all juvenile, mostly '82 yc, few '83 yc
-	17	Oct. 18	1535	Mid Reach Run	7.3	150	200	-	H18	all juvenile, 75% '83 yc, 25% '82 yc
21	-	Oct. 19	1055	Salvage, Little Denier Is.	8.2	5,000	240	-	H19	all juvenile, '82 yc, tagged 1000
22	-	Oct. 19	1400	Long Island, Fishing Cove Pt.	8.1	-	-	-	-	set went well, no catch
23	-	Oct. 19	1530	Long Island, Chappel Tickle	8.1	-	-	-	-	set went well, no catch
24	-	Oct. 20	1220	Swale Is. Tickle, Little Hr.	8.7	-	-	-	-	set went well, no catch
-	18	Oct. 20	1715	Chandler Reach, Sugar Loaf Cove	8.6	2,000	207	-	H20	mixed school, 83% '83 yc

Appendix 1 continued...

Vessel set no.					Surface temp.	Catch	Average size (mm)			
GJC	WL	Date	Time	Locality	°C	no. lbs.	Her.	Mack.	Sample no.	Comments
25	-	Oct. 20	1847	Long Island, Eastern end	8.7	3,000	238	-	H21	all juvenile, '82 yc
26	-	Oct. 20	2035	Long Island, Middle Is.	7.9	(15)	340	-	-	too shoal water, hauled seine straight, meshed 15 mature
27	-	Oct. 20	2135	Long Island, Middle Is.	7.9	6,000	346	-	H22	all mature, 50% age 11+, 36% '79 yc
28	-	Oct. 21	1520	Clode Sound, Inside narrows	7.3	1,000	189	-	H23	all juvenile, 88% '83 yc, 12% '82 yc
-	19	Oct. 21	1644	Clode Sound, Middle Pt.	8.4	5,000	183	-	H24	all juvenile, 90% '83 yc, 10% '82 yc
29	-	Oct. 21	1645	Clode Sound, Northwest Arm	7.3	500	186	-	H25	all juvenile, 75% '83 yc, 25% '82 yc
30	-	Oct. 22	1110	Goose Bay, Cannings Cove	7.3	-	-	-	-	set went well, no catch
-	20	Oct. 22	1642	Sweet Bay, Wolf Is.	8.6	-	-	-	-	set went well, fish wild, no catch
-	21	Oct. 23	1005	Southern Bay, Charleston	8.9	-	-	-	-	set went well, no catch
-	22	Oct. 23	1040	Southern Bay, Charleston	8.9	-	-	-	-	set went well, no catch
-	23	Oct. 23	1129	Southern Bay, Charleston	8.9	-	-	-	-	set went well, no catch
31	-	Oct. 23	1202	Southern Bay, Charleston	8.9	-	-	-	-	set went well, no catch
-	24	Oct. 23	1800	Long Island, Middle Tickle	7.9	(3)	240	-	-	caught 3 '82 yc only
32	-	Oct. 23	1855	Long Island, Middle Tickle	7.9	20,000	348	-	H26	all mature, 36% '79 yc, 30% age 11+
-	25	Oct. 24	1118	Blackhead Bay, Eastern Head	8.3	5,000	248	-	H27	all juvenile, '82 yc, tagged 1000
33	-	Oct. 24	1257	Blackhead Bay, Broad Head	8.2	4,000	247	-	H28	all juvenile, '82 yc
-	26	Oct. 25	1028	Trinity Bay, Spillars Cove Pt.	7.9	10,000	246	360	H29	mixed school, 90% '82 yc, few mature, tagged 2500 '82 yc
34	-	Oct. 25	1230	Trinity Bay, Cape L'Argent, Ellston	7.8	40,000	248	-	H30	mixed school, 90% '82 yc
35	-	Oct. 30	1340	Trinity Bay, Champneys Cove	7.2	-	-	-	-	set went well, no catch
-	27	Oct. 30	1340	Trinity Bay, Port Rexton	7.8	2,000	251	-	H31	all juvenile, '82 yc, tagged 1000
36	-	Oct. 30	1540	Trinity Bay, Island Cove	7.5	-	-	-	-	set upon breech of mackerel, no catch
-	28	Oct. 30	1540	Trinity Bay, Island Cove Head	7.8	-	-	-	-	set upon breech of mackerel, no catch
37	-	Oct. 30	1650	Trinity Bay, Spaniards Cove	7.9	-	-	-	-	set upon breech of mackerel, no catch
-	29	Oct. 31	1354	Trinity Bay, Grindstone Pt., Smith Sd.	6.8	2,500	90	-	H32/H33	all juvenile, '84 yc
38	-	Nov. 1	1055	Trinity Bay, Middle Cliff, Random Sd.	7.6	-	-	-	-	set went well, no catch
39	-	Nov. 1	1136	Trinity Bay, Middle Cliff, Random Sd.	7.6	-	-	-	-	set went well, no catch
40	-	Nov. 1	1342	Trinity Bay, Hatchet Cove, SW Arm	6.8	-	-	-	-	seine fouled, no catch
41	-	Nov. 1	1505	Trinity Bay, Hatchet Cove, Hillview	6.8	-	-	-	-	set went well, no catch
42	-	Nov. 3	1300	Trinity Bay, St. Jones Without Hr.	5.7	-	-	-	-	too windy, no catch
-	30	Nov. 4	0908	Trinity Bay, Bull Arm, Shag Is.	7.2	-	-	-	-	set went well, no catch
-	31	Nov. 4	1206	Trinity Bay, North Side Cattler Bay	7.8	5,000	237	-	H34	all juvenile, '82 yc, tagged 2000
43	-	Nov. 4	1620	Trinity Bay, North Side Cattler Bay	7.8	(3)	-	370	-	caught 3 mackerel only
-	32	Nov. 4	1952	Trinity Bay, Deer Hr. Head	7.5	5,000	255	-	H35	all juvenile, '82 yc, tagged 2000
44	-	Nov. 4	2005	Trinity Bay, Deer Hr. Head	7.5	1,000	245	-	H36	all juvenile, '82 yc
45	-	Nov. 5	0803	Trinity Bay, St. Jones Head	6.5	-	-	-	-	set went well, no catch
-	33	Nov. 5	0950	Trinity Bay, West Random Head	6.3	-	-	-	-	set went well, no catch
46	-	Nov. 5	1000	Trinity Bay, West Random Head	6.3	25,000	250	-	H37	all juvenile, '82 yc, tore seine

Appendix 2a. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for snallow nets).

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
A	Croque	1	-	-	-	-	0
		2	-	-	-	-	83
		3	-	-	-	-	103
		4	-	-	-	-	142
		5	-	-	-	-	951
		6	-	-	-	-	46
		7	-	-	-	-	43
		8	-	-	-	-	4
		9	-	-	-	-	18
		10	-	-	-	-	10
		11+	-	-	-	-	86
		C3+	-	-	-	-	1403
		C4+	-	-	-	-	1300
			*	*	*		
A	Westport	1	7	0	0	0	0
		2	665	462	903	41	2038
		3	732	326	1582	1954	353
		4	130	137	301	1393	873
		5	172	0	130	202	2314
		6	441	56	28	79	346
		7	42	137	0	10	198
		8	144	7	249	20	268
		9	56	42	0	145	36
		10	207	46	182	43	109
		11+	4862	2387	4939	529	4577
		C3+	6786	3138	7411	4375	9074
		C4+	6054	2812	5829	2421	8721
			*				
A	La Scie	1	0	0	-	-	-
		2	277	73	-	-	-
		3	0	59	-	-	-
		4	0	0	-	-	-
		5	77	0	-	-	-
		6	368	0	-	-	-
		7	0	179	-	-	-
		8	427	0	-	-	-
		9	35	89	-	-	-
		10	903	37	-	-	-
		11+	19884	3823	-	-	-
		C3+	21694	4187	-	-	-
		C4+	21694	4128	-	-	-

Appendix 2b. Actual catch at age (numbers of herring) from research gillnets, by area and community.

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
A	Brents Cove	1	-	-	0	0	0
		2	-	-	66	0	2260
		3	-	-	717	664	1547
		4	-	-	267	2645	2544
		5	-	-	229	432	13069
		6	-	-	137	612	1262
		7	-	-	63	871	1909
		8	-	-	792	54	2547
		9	-	-	0	933	0
		10	-	-	1340	45	1254
		11+	-	-	16254	11064	27523
		C3+	-	-	19799	17320	51655
		C4+	-	-	19082	16656	50108
B	Harry's Hr.	1	-	0	-	0	0
		2	-	3	-	0	351
		3	-	24	-	3732	255
		4	-	0	-	5166	326
		5	-	7	-	87	1048
		6	-	8	-	449	97
		7	-	105	-	1579	30
		8	-	10	-	173	124
		9	-	43	-	1075	30
		10	-	20	-	448	162
		11+	-	2178	-	21423	2458
		C3+	-	2395	-	34132	4530
		C4+	-	2371	-	30400	4275

Appendix 2c. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for shallow nets).

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
B	Leading Tickles	1	-	0	-	0	0
		2	-	62	-	0	130
		3	-	10	-	569	39
		4	-	10	-	1714	220
		5	-	108	-	132	1784
		6	-	27	-	273	278
		7	-	72	-	587	241
		8	-	14	-	47	420
		9	-	59	-	352	74
		10	-	37	-	316	319
		11+	-	2497	-	6646	7137
		C3+	-	2834	-	10636	10512
		C4+	-	2824	-	10067	10473
			*	*	*		
B	Hillgrade	1	0	0	0	0	-
		2	875	235	0	7	-
		3	277	511	0	48	-
		4	36425	88	0	194	-
		5	1446	4403	0	0	-
		6	16734	84	0	3	-
		7	308	781	0	7	-
		8	4526	0	0	2	-
		9	1390	193	0	0	-
		10	6335	21	0	0	-
		11+	65289	3301	0	24	-
		C3+	132730	9382	0	278	-
		C4+	132453	8871	0	230	-
B	Herring Neck	1	-	-	-	-	0
		2	-	-	-	-	220
		3	-	-	-	-	0
		4	-	-	-	-	393
		5	-	-	-	-	2500
		6	-	-	-	-	227
		7	-	-	-	-	198
		8	-	-	-	-	161
		9	-	-	-	-	89
		10	-	-	-	-	312
		11+	-	-	-	-	3800
		C3+	-	-	-	-	7680
		C4+	-	-	-	-	7680

Appendix 2d. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for shallow nets).

Area	Community	Age	Year 1980	1981	1982	1983	1984
A+B	Combined	1	7	0	0	0	0
		2	1817	838	960	48	5082
		3	1008	920	2299	6967	2297
		4	36554	225	568	11112	4498
		5	1694	4410	359	853	21666
		6	17542	148	165	1416	2256
		7	350	1202	63	3054	2619
		8	5096	21	1041	296	3524
		9	1481	426	0	2505	247
		10	7445	161	1522	852	2166
		11+	90034	14186	21193	39686	45581
		C3+	161203	21699	27210	66741	84854
		C4+	160195	20779	24911	59774	82557
			*	*			
C	Centreville	1	0	0	0	0	0
		2	130	133	47	16	24
		3	67	203	330	0	121
		4	123	0	81	412	81
		5	0	32	6	27	400
		6	196	32	71	16	23
		7	14	67	6	93	23
		8	11	0	13	0	57
		9	11	74	0	49	10
		10	60	0	14	9	35
		11+	2856	2377	801	805	980
		C3+	3338	2785	1322	1411	1730
		C4+	3271	2582	992	1411	1609

Appendix 2e. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for shallow nets).

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
			*	*			
C	Salvage	1	0	0	0	0	0
		2	2804	25	263	0	29
		3	158	42	4696	1438	257
		4	1631	0	1134	9553	614
		5	109	25	208	1166	6023
		6	431	0	727	442	361
		7	39	32	0	759	481
		8	109	0	145	0	199
		9	39	4	0	263	85
		10	266	0	56	188	233
		11+	9153	637	2955	5828	3374
		C3+	11935	740	9921	19637	11627
		C4+	11777	698	5225	18199	11370
C	Portland	1	-	0	0	-	-
		2	-	31	87	-	-
		3	-	86	843	-	-
		4	-	18	133	-	-
		5	-	76	25	-	-
		6	-	0	142	-	-
		7	-	196	0	-	-
		8	-	0	77	-	-
		9	-	102	0	-	-
		10	-	3	21	-	-
		11+	-	6188	1258	-	-
		C3+	-	6669	2499	-	-
		C4+	-	6583	1656	-	-

Appendix 2f. Actual catch at age (numbers of herring) from research gillnets, by area and community.

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
C	Charlottetown	1	-	-	-	0	0
		2	-	-	-	138	328
		3	-	-	-	86	306
		4	-	-	-	2497	355
		5	-	-	-	179	2747
		6	-	-	-	163	210
		7	-	-	-	346	238
		8	-	-	-	0	78
		9	-	-	-	198	50
		10	-	-	-	73	0
		11+	-	-	-	6202	1266
		C3+	-	-	-	9744	5250
		C4+	-	-	-	9658	4944
D	Port Rexton	1	-	-	0	0	0
		2	-	-	63	92	2109
		3	-	-	74	832	516
		4	-	-	49	5465	436
		5	-	-	12	1040	1798
		6	-	-	19	195	173
		7	-	-	0	1376	131
		8	-	-	20	36	81
		9	-	-	0	537	48
		10	-	-	11	0	66
		11+	-	-	1447	7600	885
		C3+	-	-	1632	17081	4134
		C4+	-	-	1558	16249	3618

Appendix 2g. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for shallow nets).

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
			*	*			
D	Hickmans Hr.	1	0	0	0	-	-
		2	175	4	5	-	-
		3	77	4	5	-	-
		4	179	0	4	-	-
		5	32	4	1	-	-
		6	172	0	2	-	-
		7	21	4	0	-	-
		8	0	0	2	-	-
		9	0	4	0	-	-
		10	46	0	1	-	-
		11+	6818	263	134	-	-
		C3+	7345	279	149	-	-
		C4+	7268	275	144	-	-
D	Long Beach		-	-	-	0	0
		2	-	-	-	79	464
		3	-	-	-	85	115
		4	-	-	-	118	225
		5	-	-	-	14	1887
		6	-	-	-	5	321
		7	-	-	-	23	185
		8	-	-	-	0	113
		9	-	-	-	13	37
		10	-	-	-	0	38
		11+	-	-	-	262	1820
		C3+	-	-	-	520	4741
		C4+	-	-	-	435	4626

Appendix 2h. Actual catch at age (numbers of herring) from research gillnets, by area and community (* adjusted by 3.50 where necessary to account for snallow nets).

Area	Community	Age	Year				
			1980	1981	1982	1983	1984
			*	*			
C&D	Combined	1	0	0	0	0	0
		2	3108	189	465	325	2954
		3	301	331	5948	2441	1315
		4	1932	318	1401	18045	1711
		5	140	133	252	2426	12855
		6	798	32	961	821	1088
		7	74	295	6	2597	1058
		8	119	0	257	36	528
		9	49	180	0	1060	230
		10	371	3	103	270	372
		11+	18827	9202	6595	20697	8325
		C3+	22610	10494	15523	48393	27482
		C4+	22309	10163	9575	45952	26167
E	Bay Roberts	1	-	-	-	0	0
		2	-	-	-	384	2496
		3	-	-	-	224	1038
		4	-	-	-	352	2449
		5	-	-	-	32	10934
		6	-	-	-	32	1092
		7	-	-	-	128	723
		8	-	-	-	0	557
		9	-	-	-	64	70
		10	-	-	-	32	62
		11+	-	-	-	1185	2868
		C3+	-	-	-	2049	19793
		C4+	-	-	-	1825	18755